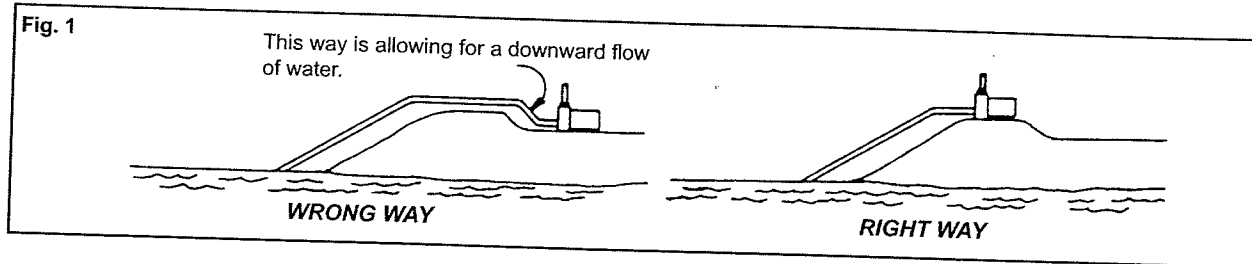


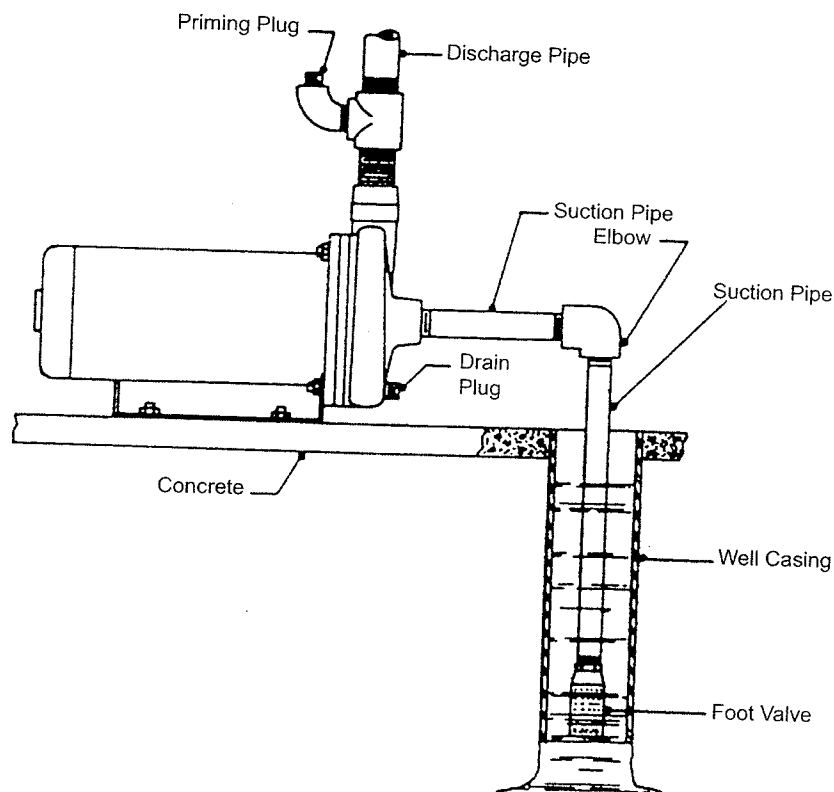
These valves are available from your pump supplier. It must be ensured that the foot valve remains well submerged at all times. If large debris is present at the suction point, install a filtration device to prevent the debris from entering the pump. Thread compound should be used on all pipe joints. All connections should

be thoroughly tightened. A leak in the suction line may prevent a complete prime and will reduce pump operating performance. Figure 2 shows a typical pump installation.



TYPICAL INSTALLATION

Fig. 2



c) DISCHARGE LINE: A priming plug should be installed as shown in Figure 2. Long hose or pipe lengths add resistance to water flow which therefore reduces pumping capacity. Use standard approved pipe or hose suitable for the pumping pressures which develop and use lengths only as necessary to reach the discharge point. Avoid using nozzles or reducing fittings on the discharge line if they are not required in your application. The discharge pipe or hose should be at least as large as the discharge thread opening on the pump casing. If long line lengths are required, increase pipe/hose size accordingly. Avoid unnecessary bends in lines. Proper installation will enable efficient service from your pump.

d) WIRING: All wiring, electrical connections, and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician. It is recommended that a separate circuit be led from the distribution panel to the pump unit. A proper fused disconnect switch is to be installed in the line, making sure that the correct gauge of cable is used to carry the load. Very long leads will require a larger cable. For all 3-Phase motors a separate manual thermal overload switch or a magnetic starter having the proper size heater elements must be installed. An electrician should be employed to do the wiring. After wiring is complete check the impeller rotation by switching the motor on for one second only.

OPERATION - PRIMING THE PUMP



WARNING: DO NOT RUN THE PUMP BEFORE PRIMING IT, SINCE THE SEAL AND IMPELLER COULD BE PERMANENTLY DAMAGED.

- a) **PRIMING:** These pumps are not self-priming. For best priming, fill the pump casing and the suction line full with water. To prime the casing – Remove the priming plug and the drain plug (See Figure 2). Pour clean water into the priming hole. Replace the drain plug. Fill the pump casing full. Rotate the motor shaft manually from the back of the motor to release internal air pockets inside the casing. Refill, if necessary at the priming hole. Replace the priming plug.
- b) **STARTUP:** Dry operation may damage the water lubricated seal inside the pump. If the pump does not deliver water within seconds after startup, stop the motor and repeat the priming operation. Several starting attempts may be necessary to expel all of the air from the pump and suction lines.
- c) **CONTINUOUS OPERATION:** Check the pump periodically for loose or rubbing parts. Service the pump immediately if any unusual noise, leaks or vibrations develop.
- d) **DRAINING:** Should the pump be subject to freezing temperatures, it will be necessary to completely drain the fluid from the pump and lines. To drain the pump casing, remove the drain plug and the priming plug. Disconnect the suction line at a connection close to the pump casing and allow the water to drain from the suction line. Operate the pump for a few seconds only to clear water from the impeller. Replace the suction line carefully cleaning the threads and applying fresh thread compound.
- e) **ROTATION:** The arrow on the front of the pump casing indicates the correct rotation of the impeller during operation. Wire the motor as described above. If it is not turning in the proper direction refer to the motor wiring instructions.

MAINTENANCE



WARNING - ELECTRICAL PRECAUTIONS

All wiring, electrical connections, and system grounding must comply with the National Electrical Code (NEC) and with any local codes and ordinances. Employ a licensed electrician.



WARNING - RISK OF ELECTRICAL SHOCK

Before servicing motor operated equipment, shut off the power at the main electrical panel and disconnect the power supply from the motor and the accessories. Use safe working practices during servicing of equipment.

- a) **LUBRICATION:** The pump itself does not need lubrication. Refer to instructions provided with the motor for motor lubrication and maintenance.
- b) **REPLACEMENT OF SEAL:** If available, refer to the repair parts list illustration showing the relative location and names of all components to assist you while following these instructions.

Disassembly:

- 1) Disconnect piping and wiring.
- 2) Remove the four nuts to dismount the pump casing from the motor housing.
- 3) Remove motor's end cover (if required).
- 4) Secure motor's shaft end with screwdriver and remove impeller by turning it counter-clockwise.
- 5) Remove the spring seal from the shaft and slide the seal plate off.
- 6) Remove the ceramic seat and its rubber housing from the seal plate.

Reassembly:

- 1) Clean all parts thoroughly. Inspect for damage or wear.
- 2) Liquid soap the rubber only of the stationary seal seat. Use clean thumbs only to press seat into seal plate. Make sure that seat is fully seated and wipe clean.
- 3) Slide the seal plate onto the shaft being careful not to damage the ceramic seat.
- 4) Lightly soap the internal rubber ring of the rotary spring seal assembly and slip in onto the motor shaft with the shiny side of the ring towards the ceramic seat.
- 5) Reassemble the impeller onto the shaft. Tighten "hand tight" only.
- 6) Place a new gasket onto the seal plate.
- 7) Place the casing into position and attach the motor using new spring washers and existing bolts. Use thread locking/sealing compound on casing to prevent leaks. Do not over-tighten the bolts.
- 8) Check that the impeller is not rubbing with the pump casing by rotating the motor shaft by hand.
- 9) Replace motor's end cover (if required).
- 10) Reconnect piping and wiring.
- 11) Reprime pump system.

PRECAUTIONS

- a) Whenever reassembly of pump is involved, check to see that the impeller rotates freely within the casing.
- b) Never remove the water flinger from the motor shaft unless replacing a damaged flinger. Be sure the motor has a flinger installed at all times.

TROUBLESHOOTING GUIDE

- a) **Pump fails to deliver water:**
 - 1) Pump is not properly primed.
 - 2) Impeller does not rotate freely within the casing.
 - 3) Suction lift is too great.
 - 4) Foot valve is either not submerged, buried in mud, or is blocked.
 - 5) Suction line is completely choked.
- b) **Pump delivers water but not at rated capacity:**
 - 1) Leaks in suction or discharge line.
 - 2) Foot valve, suction line or impeller are partially plugged.
 - 3) Suction lift is greater than recommended.
 - 4) Improper impeller rotation.
- c) **Pump loses prime:**
 - 1) Air leaks in suction line or foot valve.
 - 2) Well drawdown too great.
 - 3) Faulty foot valve.
- d) **Motor will not start:**
 - 1) No power due to blown fuses, open switches or loose connections.

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SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.13 Chlorine Analyzer-Grundfos Aquacell

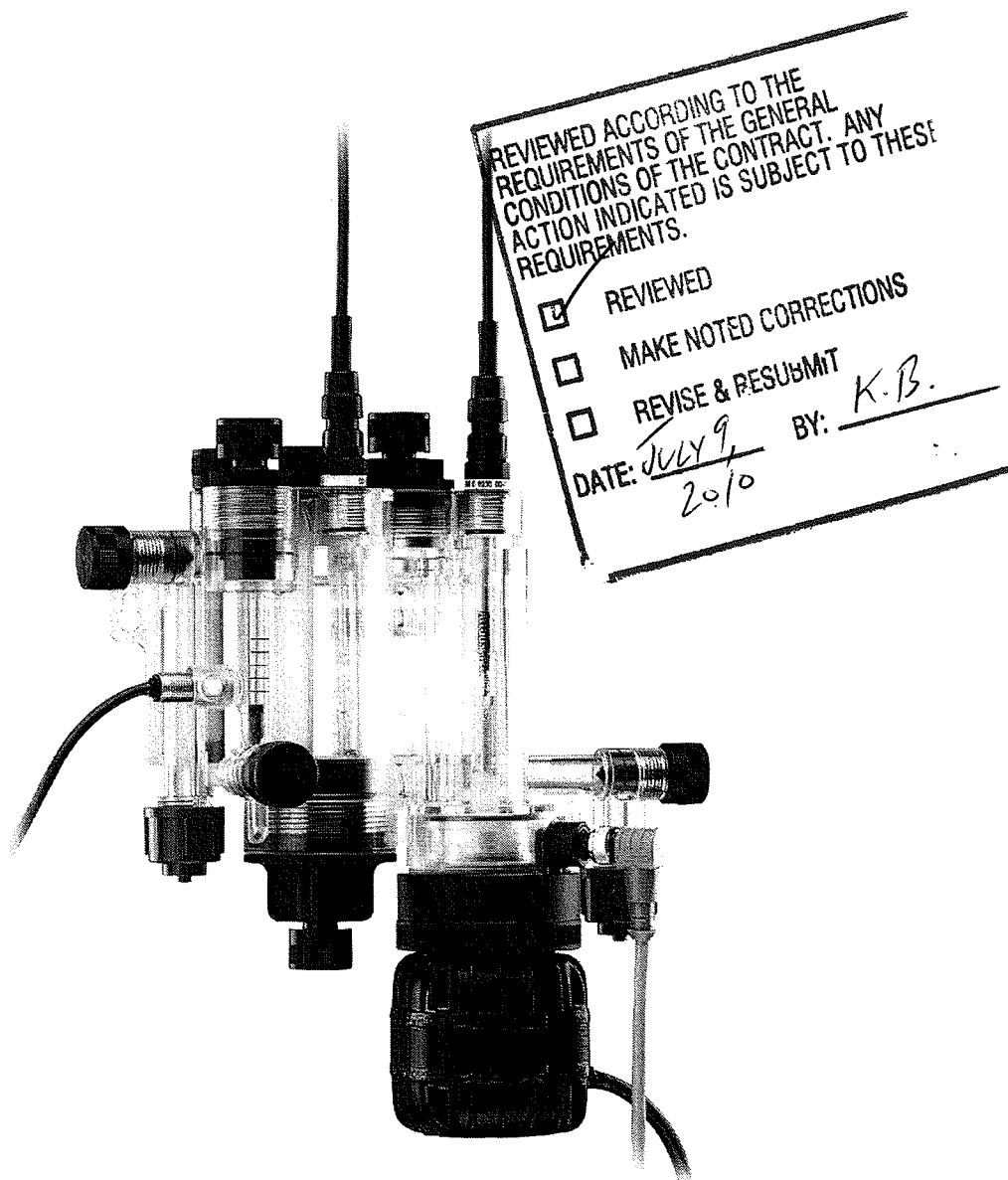
Model # Grundfos Aquacell AQC D1

Tag # AIT-316

AQC-D1

Measuring cell

Ⓒ GB Installation and operating instructions

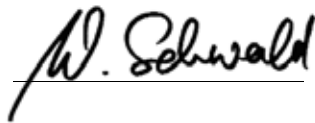


Declaration of Conformity

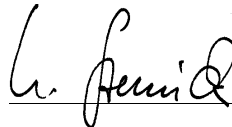
We **Grundfos Alldos** declare under our sole responsibility that the products **AquaCell AQC-D1** and the preassembled systems, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to

- Electrical equipment designed for use within certain voltage limits.
Standard used: EN 61010-1: 2002.
- Electromagnetic compatibility (89/336/EEC).
Standards used: EN 61000-3-2: 1995 + A1 + A2: 1998,
EN 61000-3-3: 1995, EN 61326: 1997 + A1: 1998, + A2: 2001,
class B, EN 61326: 1997 / A1: 1998, + A2: 2001.

Pfinztal, 1st September, 2007



W. Schwald
Managing Director



Ulrich Stemick
Technical Director

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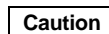
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1. Symbols used in this document

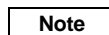


Warning

If these safety instructions are not observed, it may result in personal injury!

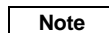


If these safety instructions are not observed, it may result in malfunction or damage to the equipment!



Notes or instructions that make the job easier and ensure safe operation.

2. Installation data



Please fill in the data below after start-up. It will help you and your Grundfos Alldos service partner to make subsequent adjustments to the installation.

Owner:

Grundfos Alldos customer number:

Order number:

Product number:

Product serial number:

Put into service on:

Location of product:

Used for:

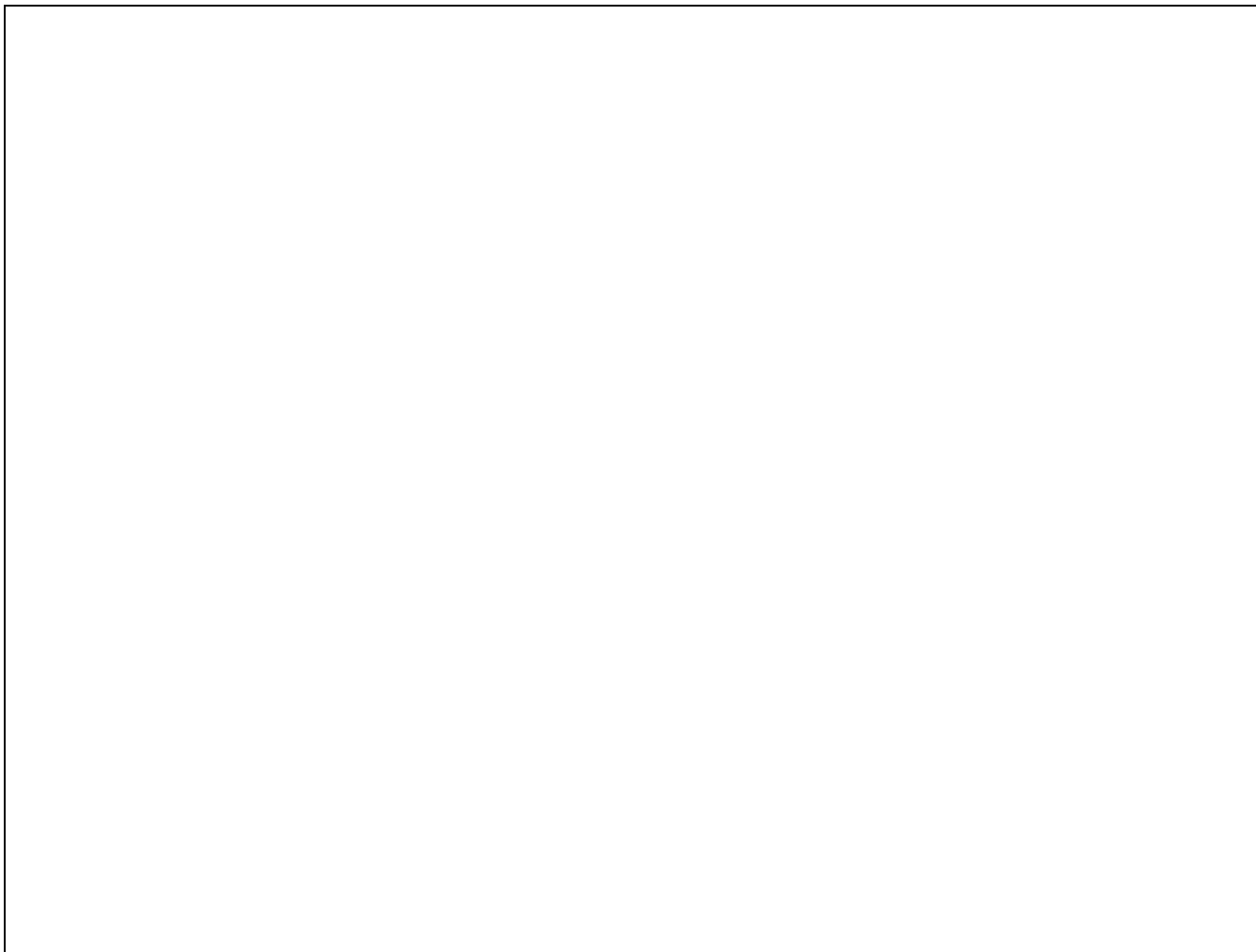


Warning

These complete installation and operating instructions are also available on www.Grundfosalldos.com.

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

3. Installation sketch



4. Unit description / preassembled systems

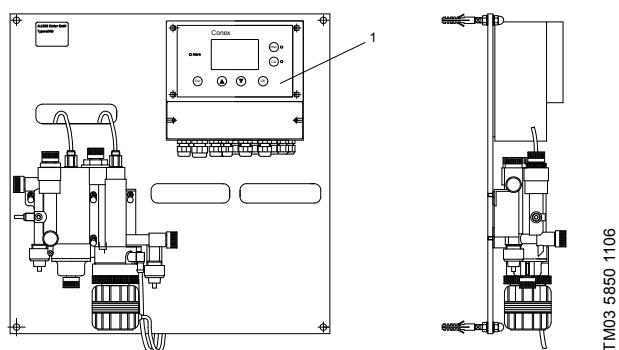


Fig. 1 AQC-D1 potentiostatic measuring cell with Conex® DIA / DIS measuring amplifier

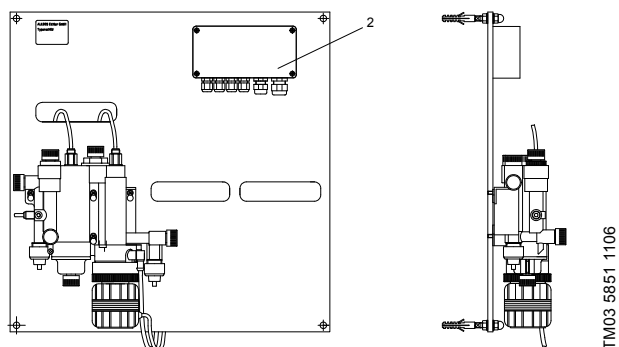


Fig. 2 AQC-D1 potentiostatic measuring cell with sensor interface

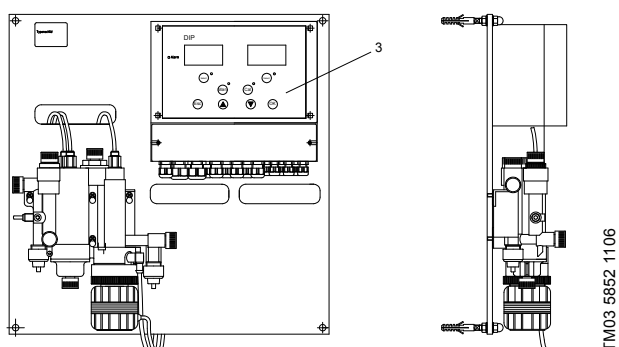


Fig. 3 AQC-D1 potentiostatic measuring cell with DIP measuring amplifier

1 Conex DIA-1, Conex DIA-2, Conex DIA-2Q, Conex DIS-D measuring amplifier

2 Sensor interface for Conex DIA-1, Conex DIA-2, Conex DIA-2Q, cabinet-mounted device

3 DIP measuring amplifier

5. Identification

5.1 Nameplate, AquaCell



TM03 8992 2807

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Maximum pressure [bar]
5	Product number
6	Year and week code
7	Country of origin

Fig. 4 Nameplate, AquaCell

5.2 Type key, AquaCell

Type key example		AQC -D1, P AU-PCB-RCB, QS -T, G				
Model						
AQC	AquaCell					
Application						
D1	Pressure-proof, with cleaning motor (Cl ₂ , ClO ₂ , O ₃)					
D2	Pressure-proof, with hydromechanical cleaning (Cl ₂ , ClO ₂ , O ₃)					
D3	Pressureless, with hydromechanical cleaning (Cl ₂ , ClO ₂ , O ₃)					
Pressure-loading valve						
P	With pressure-loading valve					
X	Without pressure-loading valve					
Electrodes						
AU	Gold					
PT	Platinum					
PCB	pH, ceramic diaphragm, with buffer solution					
PCX	pH, ceramic diaphragm, without buffer solution					
PTB	pH, PTFE diaphragm, with buffer solution					
PTX	pH, PTFE diaphragm, without buffer solution					
PKB	pH, KCl filling, with buffer solution					
PKX	pH, KCl filling, without buffer solution					
PGB	pH, gel filling, with buffer solution					
PGX	pH, gel filling, without buffer solution					
RCB	Redox, ceramic diaphragm, with buffer solution					
RCX	Redox, ceramic diaphragm, without buffer solution					
RTB	Redox, PTFE diaphragm, with buffer solution					
RTX	Redox, PTFE diaphragm, without buffer solution					
RRB	Redox, without reference system, with buffer solution					
RRX	Redox, without reference system, without buffer solution					
X	No electrode					
Flow sensor						
QS	Flow sensor					
X	No flow sensor					
Temperature sensor						
T	With Pt100					
Power supply						
G	1 x 230/240 V, 50/60 Hz					
H	1 x 115/120 V, 50/60 Hz					
I	24 VDC					
X	No power supply					

5.3 Type key, preassembled system

Example:		DIA	-1	-A	D1	P	-AU	-PCB	-QS	-T	W	-G
Units for measurement and control												
DIA-1	Dosing Instrumentation Advanced with 1 input											
DIA-2	Dosing Instrumentation Advanced with 2 inputs											
DIA-2Q	Dosing Instrumentation Advanced with 1 input + flow measurement											
DIP	Dosing Instrumentation Pool											
DIS-PR	Dosing Instrumentation Standard for pH/redox measurement											
DIS-D	Dosing Instrumentation Standard for Cl ₂ / ClO ₂ / O ₃											
Assembly												
A	Preassembled											
Cell type												
D1	Pressure-proof, with cleaning motor											
D2	Pressure-proof, with hydromechanical cleaning											
D3	Pressureless, with hydromechanical cleaning											
D4	Pressureless, with cleaning motor, for total chlorine											
D5	Pressureless, with cleaning motor, for free chlorine											
P/R	pH or redox only											
F	Fluoride only											
PA/HP	Peracetic acid or hydrogen peroxide only											
Pressure-loading valve												
P	With pressure-loading valve											
X	Without pressure-loading valve											
Electrodes for disinfection												
AU	Gold											
PT	Platinum											
X	No disinfection measurement											
Other electrodes												
PCB	pH, ceramic diaphragm, with buffer solution											
PCX	pH, ceramic diaphragm, without buffer solution											
PTB	pH, PTFE diaphragm, with buffer solution											
PTX	pH, PTFE diaphragm, without buffer solution											
PKB	pH, KCl filling, with buffer solution											
PKX	pH, KCl filling, without buffer solution											
PGB	pH, gel filling, with buffer solution											
PGX	pH, gel filling, without buffer solution											
RCB	Redox, ceramic diaphragm, with buffer solution											
RCX	Redox, ceramic diaphragm, without buffer solution											
RTB	Redox, PTFE diaphragm, with buffer solution											
RTX	Redox, PTFE diaphragm, without buffer solution											
RRB	Redox, without reference system, with buffer solution											
RRX	Redox, without reference system, without buffer solution											
F	Fluoride											
PA	Peracetic acid											
HP	Hydrogen peroxide											
X	No electrode											
Flow sensor												
QS	Flow sensor integrated											
X	No flow sensor											
Temperature sensor												
T	With Pt100											
X	No temperature sensor											
Mounting												
W	Wall-mounted											
P	Panel-mounted											
Power supply												
G	1 x 230 V, 50/60 Hz											
H	1 x 120 V, 50/60 Hz											
I	24 VDC											

6. Unit description / holders for electrodes and sensors

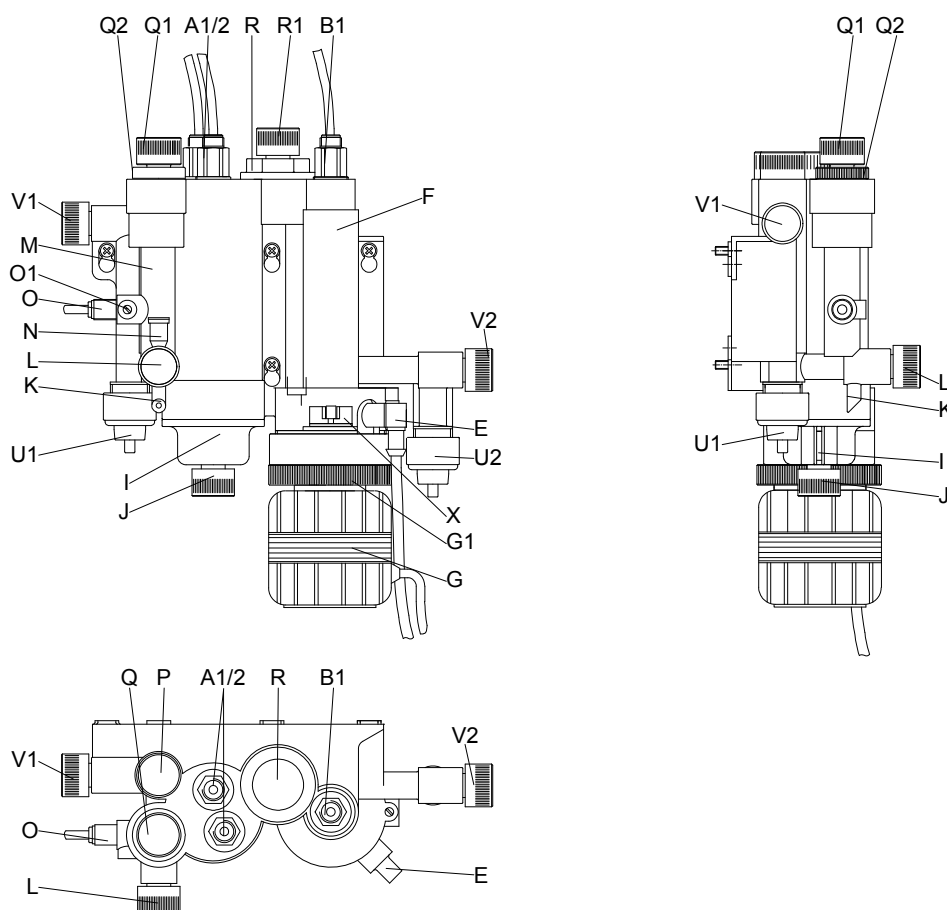


Fig. 5 AQC-D1 potentiostatic measuring cell (pressure-proof, with cleaning motor)

Pos.	Component
A	Holders for pH single-rod electrode and redox electrode (optional)
A1 / 2	pH single-rod electrode and redox electrode (optional)
B	Holder for reference electrode
B1	Reference electrode (Cl ₂ , ClO ₂ , O ₃)
E	Plug for measuring electrode
F	Flow armature
G	Cleaning motor
G1	Slide
I	Calibration cup with sample water outlet
J	Evacuation spindle (on the calibration cup)
K	Sample water extraction device with extraction spindle
L	Bleeding spindle
M	Measuring tube
N	Float body
O	Water sensor (optional)
O1	Screw
P	Filter cartridge
Q	Sample water regulating device
Q1	Adjusting spindle
Q2	Valve insert
R	Screw plug
R1	Deaeration spindle
U1	Connection for sample water inlet
U2	Connection for sample water outlet
V1	Shut-off spindle for sample water inlet
V2	Shut-off spindle for sample water outlet
X	Cleaning wing

These positions that are described later on in the document are not shown in the diagram:

Pos.	Component
D	Measuring electrode (Cl ₂ , ClO ₂ , O ₃) with integrated Pt100
H	Screwed part with slide, inlet chamber, cleaning wing and measuring electrode
P1	Filter for screw cap
P2	Filter strainer
P3	Filter receptacle
V	Pressure-loading valve, 0.3 bar, with adaptor
W	Inlet chamber
W1	O-rings of the inlet chamber

TM03 5853 1106

7. General information

This manual contains all important information for users of the AquaCell AQC-D1 and the preassembled systems:

- technical data
- instructions for start-up, use and maintenance
- safety information.

Should you require further information, or should problems occur which are not handled in sufficient depth in this manual, please contact Grundfos Alldos. We will enjoy supporting you with our comprehensive know-how in the fields of measurement and control as well as water treatment.

We always welcome any suggestions on how to optimise our installation and operating instructions to satisfy our customers.

7.1 Guarantee

A guarantee claim in the sense of our general conditions of sale and delivery can only be recognised if these requirements are complied with:

- The device has been used according to the information in this manual.
- The device has not been dismantled or incorrectly handled in any manner.
- Repairs have only been carried out by authorised personnel.
- Only original parts have been used during repairs.
- Only components approved by Grundfos Alldos are used in the complete plant.

Typical parts subject to wear are excluded from the guarantee, for instance a gaskets, magnetic stirrer, reference electrode and pH redox single-rod electrodes.

8. Applications

The AQC-D1 potentiostatic measuring cell is used for measuring the concentration of chlorine (Cl_2) in the pH-range 4.5 to 8.5, chlorine dioxide (ClO_2) or ozone (O_3). By means of the suitable single-rod electrodes, it can also measure the pH value and redox potential in plants for treating swimming-pool water and drinking water.

The preassembled systems measure and control the following, depending on the measuring amplifier and controller installed:

- Preassembled system with Conex[®] DIA-1 measuring amplifier and controller:
 - Measurement: free chlorine (Cl_2), as an option with pH compensation, chlorine dioxide (ClO_2), ozone (O_3), pH, temperature.
 - Control: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3).
- Preassembled system with Conex[®] DIA-2 measuring amplifier and controller:
 - Measurement: free chlorine (Cl_2), as an option with pH compensation, chlorine dioxide (ClO_2), ozone (O_3), pH, temperature.
 - Control: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3), pH.
- Preassembled system with Conex[®] DIA-2Q measuring amplifier and controller:
 - Measurement: free chlorine (Cl_2), as an option with pH compensation, chlorine dioxide (ClO_2), ozone (O_3), pH, temperature.
 - Control: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3), pH, redox potential.
- Preassembled system with Conex[®] DIS-D measuring amplifier and controller:

- Measurement: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3).
- Control: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3).
- Preassembled system with DIP measuring amplifier and controller:
 - Measurement: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3), pH, redox potential, temperature.
 - Control: chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3), pH.

9. Safety information

9.1 Obligations of the owner

The owner of the plant is responsible for

- compliance with country-specific safety regulations
- training of operating personnel
- provision of prescribed protective gear
- implementation of regular maintenance.

9.2 Avoidance of danger



Warning

Do not dismantle the device components!

Cleaning, maintenance and repairs must only be carried out by authorised personnel!



Warning

Other applications than those described in section 8. Applications are considered as non-approved and are not permissible. Grundfos Alldos cannot be held liable for any damage resulting from incorrect use.

Derivates of chlorine isocyanic acid cannot be measured or controlled. Grundfos Alldos cannot be held liable for damage or consequential damage regarding this.

10. Technical data

10.1 General data

- AQC-D1: motor-driven pressure-proof flow armature for recirculation of sample water.
- Measuring parameters:
 - free chlorine, chlorine dioxide, ozone
 - optional: pH value, redox potential, temperature (for compensation of pH, Cl₂, ClO₂, O₃).
- Sample water:
 - min. conductivity: 50 µS/cm
 - temperature: 0 to 50 °C
 - pH value (only measuring parameter Cl₂: pH 4.5-8.5)
 - inlet pressure: max. 4 bar, min. 0.3 bar
 - counter-pressure: max. 3.7 bar
 - pressure difference: max. 0.3 bar.
- Permissible ambient temperature: 0 to 40 °C.
- Permissible storage temperature:
 - -20 to +65 °C
 - Electrodes: -10 to +30 °C.

Caution *Observe the installation and operating instructions of the electrodes!*

- Permissible humidity: max. 90 % relative humidity (no condensation).
- Sample water flow rate: min. 20; max. 60 l/h.
- Materials of parts that come into contact with the media: PMMA, PVC, steel, PTFE, EPDM.
- Electrode materials: Glass, metal, noble metal, PPO (polyphenylene oxide), PA 6.6.
- Connections:
 - inlet: for PVC tube 6/12 or PVC pipe 12 x 1.2
 - outlet: for PVC tube 6/12 or PVC pipe 12 x 1.2.

Cleaning motor

- Supply voltage:
 - 230/240 V (50/60 Hz)
 - 115-120 V (50/60 Hz)
 - 24 VDC.
- Input power: 10 W.

Measuring parameters: chlorine, chlorine dioxide and ozone

- Measuring ranges: Dependent on the measuring amplifier. See section [10.3.1 Measuring range for measuring parameters Cl₂, ClO₂, O₃, pH, Redox](#).
- Sensitivity: < 10 ppb.
- Accuracy: < ± 5 % of full-scale value.
- Repeatability: < ± 3 %.
- Response time: t₉₀ < 60 s.

10.2 Versions

- Power supply:
 - 230/240 V (50/60 Hz) (standard)
 - 115-120 V (50/60 Hz)
 - 24 VDC.
- Equipment / options:
 - electrode (gold) (standard) (for free chlorine, chlorine dioxide, ozone)
 - electrode (platinum)
 - redox single-rod electrode
 - redox electrode (with DIP)
 - pH single-rod electrode.

10.2.1 AquaCell AQC-D1 potentiostatic measuring cell

- Cables:
 - cable for reference electrode, pH or redox single-rod electrode, 3 m, with free cable end
 - cable for measuring electrode, 3 m, with free cable end.
- Options:

- water sensor with cable, 3 m
- pressure-loading valve.

10.2.2 Preassembled systems

- Cables:
 - cable for reference electrode, pH or redox single-rod electrode, 1 m, preconnected
 - cable for measuring electrode, 1 m, preconnected.
- Options:
 - water sensor with cable, 1 m
 - pressure-loading valve.

Product numbers of the spare parts and optional accessories, see section [16. Spare parts and accessories](#).

10.3 Measuring ranges

10.3.1 Measuring range for measuring parameters Cl₂, ClO₂, O₃, pH, Redox

Preassembled system with Conex DIA

Cl ₂ [mg/l]	ClO ₂ [mg/l]	O ₃ [mg/l]	pH	Redox (ORP) [mV]
0.00-0.50	0.00-0.50	0.00-0.50	0.00-14.00	-1500- +1500
0.00-1.00	0.00-1.00	0.00-1.00	2.00-12.00	0-1000
0.00-2.00	0.00-2.00	0.00-2.00	5.00-9.00	
0.00-5.00	0.00-5.00	0.00-5.00		
0.0-10.0	0.0-10.0			
0.0-20.0				
freely selectable between				
0.0-50.0	0.0-50.0	0.00-5.00	0.00-14.00	-1500- +1500

Preassembled system with Conex DIS-D

Cl ₂ [mg/l]	ClO ₂ [mg/l]	O ₃ [mg/l]
0.00-2.00	0.00-2.00	0.00-2.00
0.00-20.00	0.00-20.00	0.00-5.00

Preassembled system with DIP

Cl ₂ [mg/l]	ClO ₂ [mg/l]	O ₃ [mg/l]	pH	Redox (ORP) [mV]
0.00-0.50	0.00-0.50	0.00-0.50	0.00-14.00	-1500- +1500
0.00-1.00	0.00-1.00	0.00-1.00	2.00-12.00	0-1000
0.00-2.00	0.00-2.00	0.00-2.00	5.00-9.00	
0.00-5.00	0.00-5.00	0.00-5.00		
0.0-10.0	0.0-50.0			
0.0-30.0				
freely selectable between				
0.0-30.0	0.0-50.0	0.00-5.00	0.00-14.00	-1500- +1500

10.3.2 Measuring range for temperature (not with Conex DIS-D)

°C	°F
0 to +50	32 to 122
0 to +100	32 to 212
-5 to +120	23 to 248

10.4 Dimensional sketches / drilling diagram

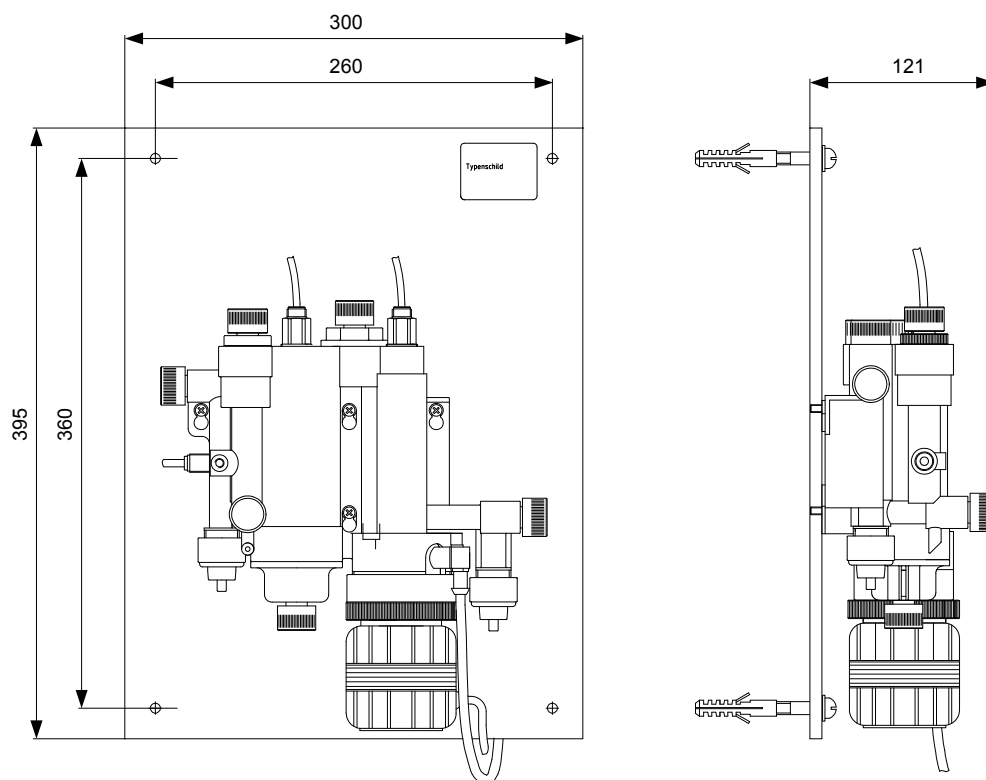


Fig. 6 Drilling diagram for AQC-D1 measuring cell

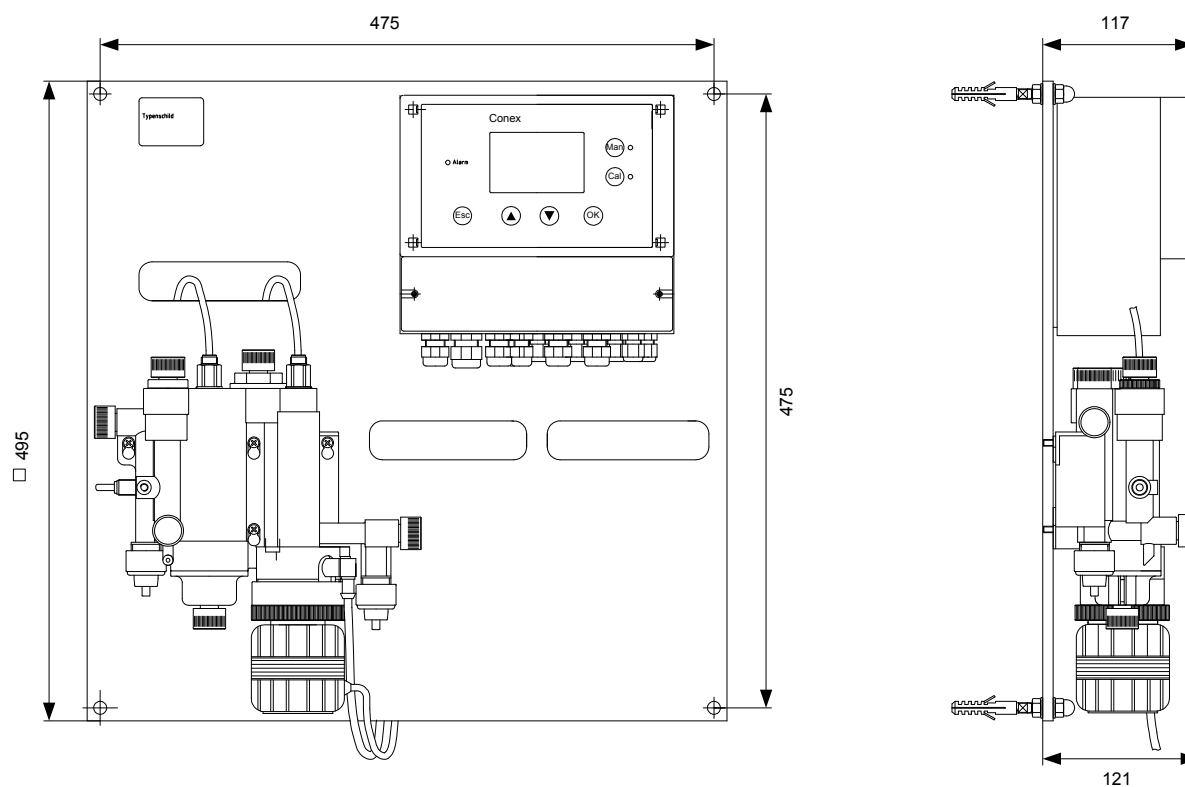


Fig. 7 Drilling diagram for preassembled systems. Example with Conex DIA (wall-mounted unit)

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11. Installation

11.1 Transport and storage

Transport unit carefully, do not throw, store in dry conditions between -20 and $+65$ °C.

Caution *Store electrodes between -10 and $+30$ °C. Keep protective caps moist with 3-molar potassium chloride solution.*

11.2 Unpacking

Caution *Do not allow any foreign bodies to enter!*

- Check scope of delivery.
- Assemble as soon as possible following unpacking.

11.3 Installation requirements



Warning!

For safety reasons, the customer must install an earth leakage circuit breaker for the cleaning motor of the measuring cell and the measuring amplifier.

Caution *Non-observance of the general installation requirements may result in damage or errors in measurement!*

For safety during service and maintenance, the measuring amplifier and the measuring cell must be switched off at all poles.

Note *To make the switching off easy, we suggest installing an all-pole mains switch in front of the measuring amplifier.*

- The location must be vibration-free, dry, dust-free and free of corrosive, pungent fumes or aggressive solvents.
- Maximum permissible cable length:
 - Individual devices for AQC-D1 measuring cells: between measuring cell and measuring amplifier or sensor interface: 3 m.
 - Preassembled systems with Conex DIS, DIA or DIP as wall-mounted unit: completely prewired.
 - Preassembled systems with Conex DIA as control cabinet unit: Distance between measuring amplifier and sensor interface ≤ 100 m.
- Ensure a continuous supply of sample water.
- Install the measuring cell so that the line length of the sample water feed is as short as possible in order to reduce the delay time of the flow armature.
- Retain the permissible inlet pressure and counter-pressure of the sample water.
 - Fit a pressure booster pump or pressure reducer, if necessary.

If the counter-pressure is under 0.3 bar, or if there is an open outflow, fit the pressure-loading valve (V) to the outlet of the measuring cell (U2). It is available together with an adaptor for the measuring cell, Grundfos Alldos product number 96609179 (12.6459-400).

11.4 Mounting

The flow armature is fastened to the mounting plate from factory.

Caution *The measuring cell breaks when the screws are tightened! Do not tighten the screws; only screw them in without tightening them!*

Caution *The potentiostatic measuring cell or preassembled system must be mounted vertically!*

Individual device for AQC-D1 measuring cells

1. Drill four dowel holes with a diameter of 10 mm and min. 60 mm deep. See section [10.4 Dimensional sketches / drilling diagram](#).
2. Mount the measuring cell and the mounting plate on the wall using the mounting material provided.

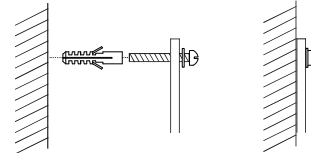


Fig. 8 Mounting of AQC-D1 measuring cell

Preassembled systems

1. Drill four dowel holes with a diameter of 10 mm and min. 60 mm deep. See section [10.4 Dimensional sketches / drilling diagram](#).
2. Mount the preassembled system and the mounting plate on the wall using the mounting material provided. Distance between the mounting plate and the wall: min. 20 mm.

Caution *Do not pinch the cable! Always observe the mounting sequence below.*

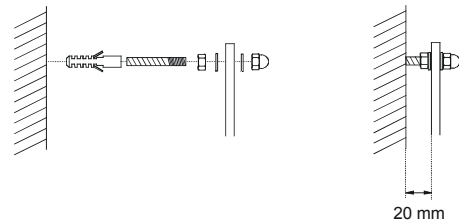


Fig. 9 Mounting sequence for preassembled systems

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12. Start-up

12.1 Installation of electrodes and sensors

12.1.1 Reference electrode, pH and redox single-rod electrodes

1. Unscrew the screw plugs of the holders (A, B) used for the flow armature (F).
2. Remove the moisture retention caps of the electrodes or single-rod electrodes (A1, A2, B1) used, and keep them for possible electrode removal.
3. Screw in the electrodes or single-rod electrodes (A1, A2, B1) used by hand into the holders (A or B).

Caution *Observe the installation and operating instructions of the electrodes!*

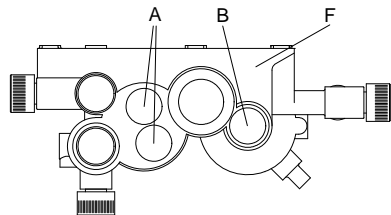


Fig. 10 Holders for electrodes

12.1.2 Water sensor

The water sensor (O) is optional.

Note *The holder for the water sensor is on the float body.*

1. Screw the water sensor (O) into the appropriate holder of the measuring cell, and secure it using the screw.
2. Slacken the screw (O1), insert the water sensor as far as it will go (O), and gently tighten the screw.

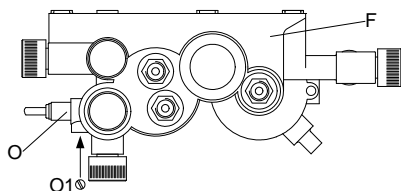


Fig. 11 Holder for water sensor

12.1.3 Temperature sensor

Note *The Pt100 temperature sensor is integrated into the measuring electrode (D).*

12.2 Water connections

Caution *Only tighten the union nut by hand. Do not use any tools!*

For the pressure-proof measuring cell, a pressure-loading valve must be fitted to the outlet of the flow armature if the counter-pressure may fall below 0.3 bar (for instance if there is an open outflow).

Product number	Component
96609179 (12.6459-400)	Pressure-loading valve (V) with adaptor

12.2.1 Mounting the pressure-loading valve

1. Unscrew the connection of the sample water outlet (U2).
2. Screw the pressure-loading valve and adaptor (V) onto the measuring cell outlet.
3. Screw the connection of the sample water outlet (U2) onto the pressure-loading valve.

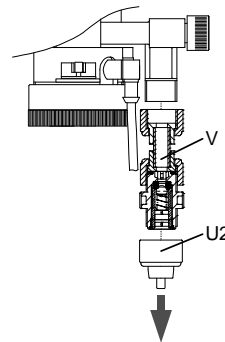


Fig. 12 Pressure-loading valve

Caution

Observe the correct installation of the pressure-loading valve. See the arrow on the pressure-loading valve. The arrow must point in the flow direction!



Warning

At a pressure of more than 4 bar and if the measuring cell is not deaerated, the cell might burst. Do not exceed the max. system pressure of 4 bar. Fit a pressure reducer, if necessary.

Caution

Observe the local pressure! The permissible primary water pressure is 0.3 to 4 bar. Fit a pressure booster pump, if necessary. Check the tightness of the measuring cell.

4. Close the shut-off spindle for sample water inlet (V1) and outlet (V2).
5. Connect the sample water inlet and outlet to the connections of the sample water inlet (U1) and outlet (U2).

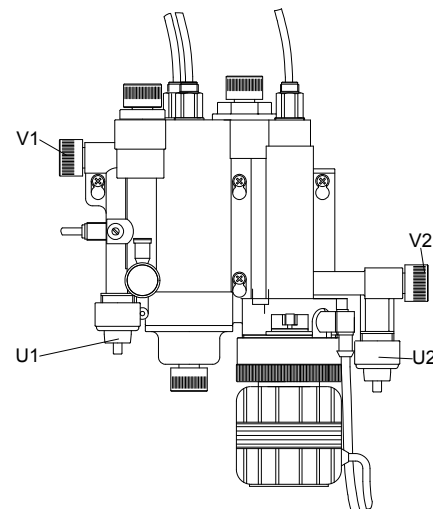


Fig. 13 Water connections

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12.3 Floater stopper

The measuring cell is supplied with a built-in floater stopper. If the sample water flow rate is increased, the float body (N) will therefore not move outside of the detection range of the water sensor (O). See the figure in section [12.3.1 Removing the floater stopper](#). An alarm is not triggered, and the control output remains active.

The advantage of this is that in the event of frequent peaks in the sample water flow rate, the alarm is not continuously triggered, and the control output remains active.

Warning

If the sample water flow rate is set too high or is increased temporarily, no alarm is triggered, and the control output remains active!

If the sample water flow rate is set too high or is increased temporarily, there is a risk that the sample water will overflow at the overflow mechanism. In this state, no alarm is triggered, and the control output remains active!



If the detection range of increased sample water flow rate is to be activated, the floater stopper must be removed. When the floater stopper is removed, an alarm is triggered, and the control output is disabled each time the sample water flow rate is increased.

12.3.1 Removing the floater stopper

1. Close the water supply to the measuring cell.

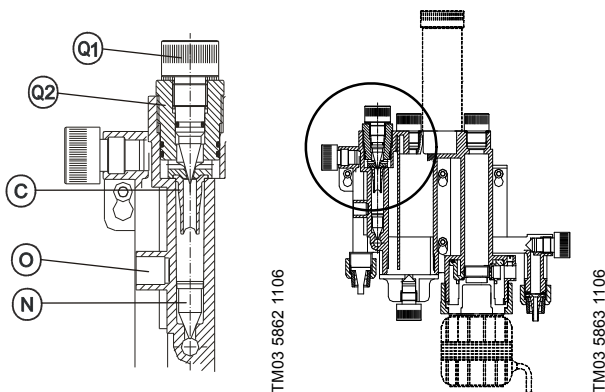


Fig. 14 Floater stopper

2. Unscrew the adjusting spindle (Q1) from the valve (Q2).
3. Unscrew the valve (Q2) from the fittings.



Fig. 15 Removing the floater stopper - part 1

4. Remove the floater stopper (C) from the fittings (for instance using a pair of tweezers).



Fig. 16 Removing the floater stopper - part 2

5. Screw the valve (Q2) into the fittings.
6. Screw the adjusting spindle (Q1) into the valve (Q2).
7. Open the water supply to the measuring cell, and set the desired water flow rate with the adjusting spindle (Q2).

12.4 Preparing the electrode cable for connection to the measuring amplifier

Note

The preassembled systems are prewired.

Warning

The electrical connection should be carried out by qualified personnel!

Observe the local safety regulations!

Protect the cable connections and plugs against corrosion and humidity.



Cables for single-rod electrodes or electrodes (A1, A2, B1)

1. Cut the electrode cables to the desired length + approximately 80 mm for the connections.
2. Remove 80 mm of the outer insulation.
3. Disentangle the braided screen until you reach the next part of the insulation, and twist it to form a wire.
4. Strip the braided screen (for instance using a shrink tube), and fit a wire end ferrule.
5. Remove the black (conductive) sheath of the insulated electrode wire until you reach the insulation.
6. Fit a wire end ferrule to the electrode wire.

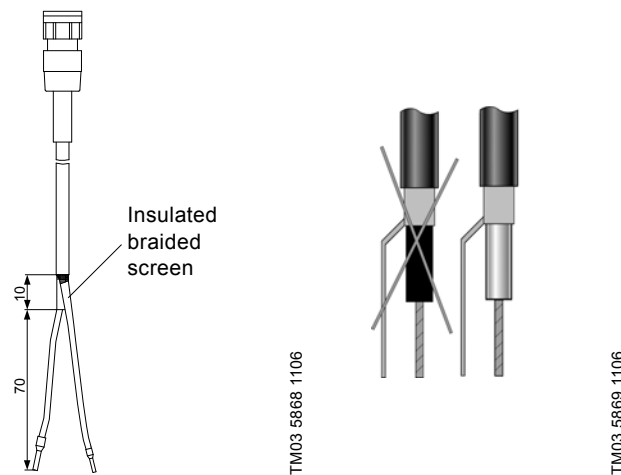
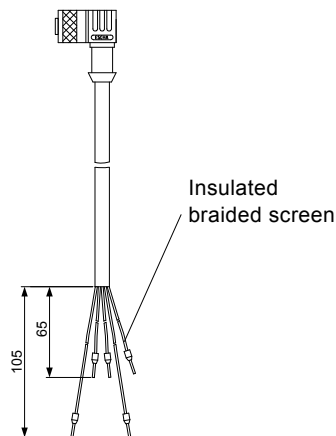


Fig. 17 Cable for single-rod electrode or electrodes (A1, A2, B1)

Cable from measuring electrode (D)

1. Cut the electrode cables to the desired length + approximately 105 mm for the connections.
2. Remove 105 mm of the outer insulation.
3. Disentangle the braided screen until you reach the next part of the insulation.
4. Cut the enclosed braided screen to 65 mm, isolate it (for instance using a shrink tube), and fit a wire end ferrule. Then remove the rest of the screen until you reach the insulation.
5. Cut the brown and white insulated wire of the measuring electrode and counter-electrode to 65 mm, and fit wire end ferrules.
6. Fit wire end ferrules to the blue and black insulated wires of the temperature sensor.



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Fig. 18 Cable from measuring electrode (D)

Pin	Component
Pin 1 brown	Measuring electrode M
Pin 2 white	Counter-electrode G/C
Pin 3 blue	Pt100 temperature sensor
Pin 4 black	Pt100 temperature sensor

12.5 Electrical connections

Warning

The electrical connection should be carried out by qualified personnel!

Before connecting the supply cables, check that the supply voltage specified on the type plate corresponds to the local conditions!

Before connecting the supply cables, switch off the electricity supply!

Observe the local safety regulations!

Protect the cable connections and plugs against corrosion and humidity.

Connect an earth leakage circuit breaker in front of the measuring amplifier and the cleaning motor.

For safety during service and maintenance, the measuring amplifier and the measuring cell must be switched off at all poles.

To make the switching off easy, we suggest installing an all-pole mains switch in front of the measuring amplifier.

Note

Preassembled systems

The preassembled systems are prewired.

1. Connect an earth leakage circuit breaker in front of the measuring amplifier and the cleaning motor.
2. Connect the electricity supply to the measuring amplifier.

Caution

Observe the installation and operating instructions of the measuring amplifier!

AQC-D1 measuring cell

Note

The cables are not preconnected. See section 12.4 Preparing the electrode cable for connection to the measuring amplifier.

Caution

Observe the installation and operating instructions of the measuring amplifier!

1. Connect electrodes to the corresponding terminals of the measuring amplifier.
2. Connect measuring electrodes (D) to the corresponding terminals of the measuring amplifier. Fit the screen according to the installation and operating instructions of the measuring instrument.

Caution

The temperature sensor cannot be used with Conex DIS-D. Place the cables of the temperature sensor so that no short-circuit can occur!

3. Connect the water sensor to the corresponding terminals of the measuring amplifier.
4. Connect an earth leakage circuit breaker in front of the measuring amplifier and the cleaning motor.
5. Connect the cleaning motor to the measuring amplifier in accordance with local regulations.
6. Connect the electricity supply to the measuring amplifier.

Caution

Before connecting the supply cables, check that the supply voltage specified on the nameplate corresponds to the local conditions! Observe the installation and operating instructions of the measuring amplifier!

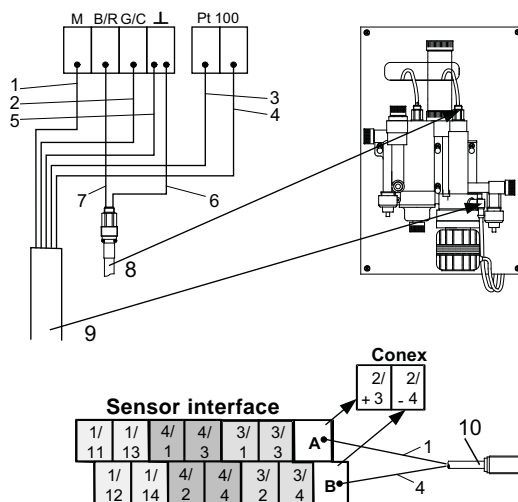


Fig. 19 Conex DIA-1 for mounting in a control panel

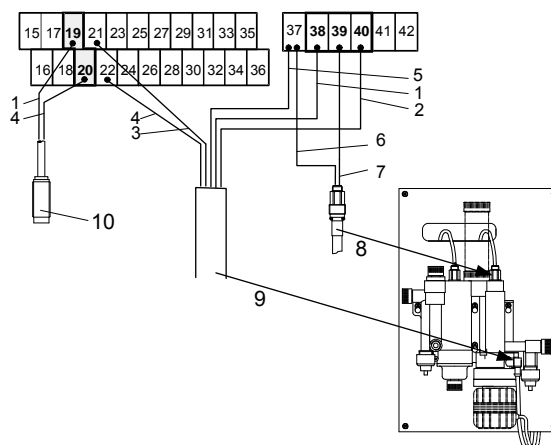


Fig. 20 Conex DIA-1 for wall mounting

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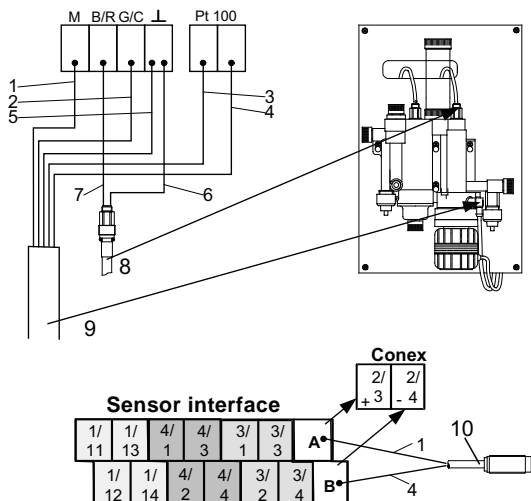


Fig. 21 Conex DIA-2 for mounting in a control panel

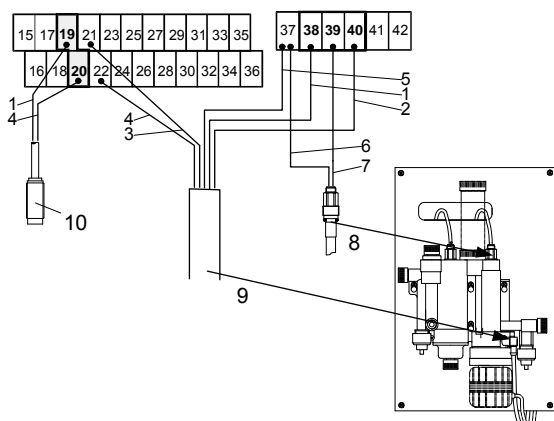


Fig. 22 Conex DIA-2 for wall mounting

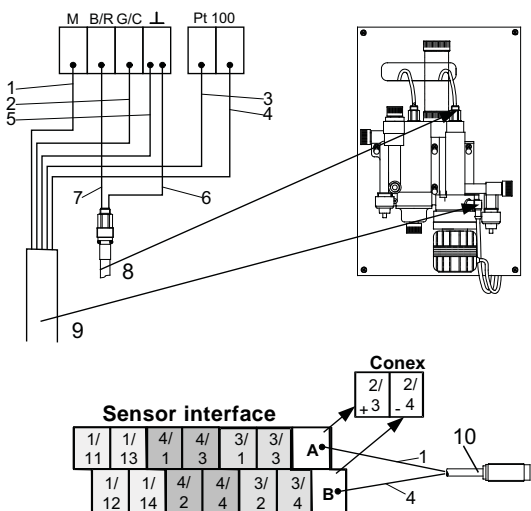


Fig. 23 Conex DIA-2Q for mounting in a control panel

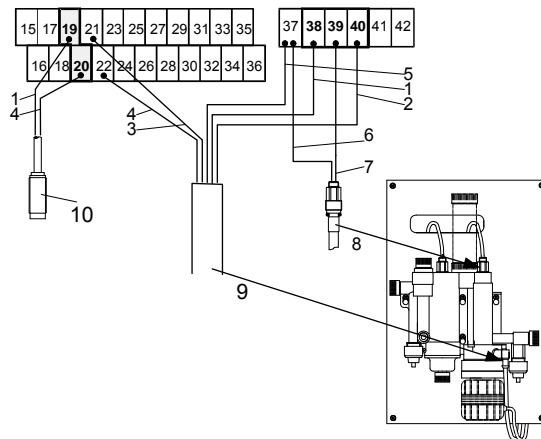


Fig. 24 Conex DIA-2Q for wall mounting

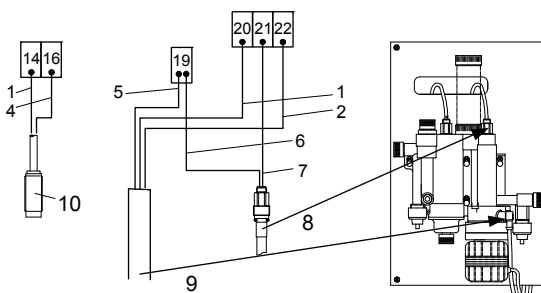


Fig. 25 Conex DIS-D

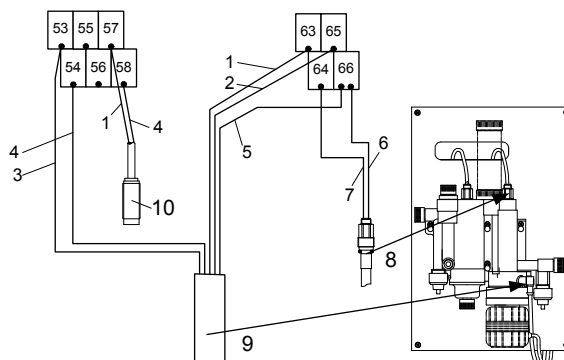


Fig. 26 DIP

Pos.	Component
1	Brown
2	White
3	Black
4	Blue
5	Screen
6	Outer conductor (screen)
7	Inner conductor
8	Reference electrode
	Measuring electrode
9	Counter-electrode
	Pt100 temperature sensor (not with Conex DIS-C)
10	Water sensor

12.6 Checks prior to start-up

- Check the tightness of the whole system.
- Check the electrical connections.

12.7 Switching on

Caution

Observe the installation and operating instructions of the measuring amplifier and device controlled!



Warning

At a pressure of more than 4 bar, and if the measuring cell is not deaerated, the cell may burst. Ensure draining and deaeration. Do not exceed the max. system pressure of 4 bar. Do not put a damaged measuring cell under pressure!

Caution

At first start-up or after a long-term stop: Let the system run for at least two hours to avoid faulty measurements and calibration!

1. Close the bleeding spindle (L) and the deaeration spindle (R1).
2. Close the evacuation spindle (J).
3. Open the shut-off spindle for sample water outlet (V2) 2-3 turns.
4. Gradually open the shut-off spindle for sample water inlet (V2) 2-3 turns.
 - Avoid turbulent flow!
5. Check that the cleaning wing (X) rotates.
 - Try, if necessary, to briefly increase the quantity of sample water with the adjusting spindle (Q1) in order to move the cleaning wing (X).
 - If the cleaning wing (X) still does not rotate, check and correct its position, if necessary. See section [14. Maintenance](#).
6. Switch on the measuring amplifier.
7. Only switch on the device controlled after the first calibration, if necessary.

12.7.1 Setting the quantity of sample water

- Set an average quantity of sample water with the adjustment spindle (O1) so that the float body (N) is in the middle of the measuring tube (M). (In order for the water sensor to work, the float body must be at the height of the water sensor.)

12.8 Calibrating the parameters Cl_2 , ClO_2 , O_3

Caution

At first start-up or after a long-term stop: Let the system run for at least two hours to avoid faulty measurements and calibration!

Due to the electro-chemical behaviour of the measuring cell, no zero-point adjustment is necessary. Only the rate of rise (sensitivity) must be adjusted during calibration.

Caution

During the calibration: Keep the pH value, sample water flow rate and water temperature constant.

- Check the calibration after 24 hours, and repeat, if necessary!

12.8.1 Photometrical measurement

1. Open the bleeding spindle (L), and let the water run for a few seconds.
2. Take a water sample, and close the bleeding spindle (L).
3. Determine the concentration of the measuring parameter photometrically, for instance using the Grundfos Alldos DIT hand photometer.

Caution

Observe the installation and operating instructions of the photometer!

12.8.2 Calibration example based on chlorine measurement with pH compensation (not with Conex DIS-D)

Caution

Observe the installation and operating instructions of the measuring amplifier!

- If not done yet: Define the basic settings for the measuring amplifier.

Note

When carrying out a chlorine measurement with pH compensation, the pH value must be calibrated first, since the pH value is used when calibrating the chlorine value!

Note

It is not necessary to remove the pH or redox single-rod electrodes for calibration. Simply fill the calibration cup (I) with the relevant buffer solution.

Filling the calibration cup (I) with the relevant buffer solution

1. Close the shut-off spindle for sample water inlet (V1) and outlet (V2).
2. Open the deaeration spindle (R1), open the evacuation spindle (J), and drain the sample water through the slit in the calibration cup (I).
3. Unscrew the calibration cup (I), and tighten the evacuation spindle (J) again.
4. Fill the calibration cup (I) up to the mark with buffer solution, and then loosely screw it back into the flow armature (F) by hand.

This position ensures that the electrodes are immersed deeply enough in the buffer solution.

Calibrating the pH value

- DIP: Select the right-hand display for pH with the Select button.
 - Conex DIA and DIP: Use the CAL button to select the calibration function CAL. The LED illuminates.
1. If necessary, enter the code number for Cal (or full) authorisation.
 2. Change to the menu "calibration" with the OK button.
 3. Select the measured variable "pH", and confirm with OK.
 - Selection possibilities: "cal. meas. value" (= measured value), "cal result" and "cal cycle" (= count-down function which triggers the alarm "Calibrate sensor" after a selectable time interval of 1-100 days).
 4. Select the line "cal. meas. value" with UP/DOWN.

pH
cal. meas. value
cal result
cal cycle

5. Select one of the defined buffer solutions ("GRUNDFOS", "DIN/NIST", the optional setting "others"), and press OK.
 - The menu "temperature" is then selected automatically.

buffer
GRUNDFOS
DIN/NIST
others

6. Enter the temperature of the buffer solutions.
7. Press OK to automatically jump to the menu "buffer value 1".
8. "GRUNDFOS" or "DIN/NIST" buffer solutions: Select one of the three available buffer values.

buffer value 1
4.01 pH
7.00 pH
9.18 pH

Buffer 1

1. Fill the calibration cup (I) up to the mark with buffer solution.
2. Screw the calibration cup (I) into the flow armature (F).
 - Once the buffer values have been read by the measuring amplifier, the temperature of the sample water and the measured signal are automatically read.
3. Then discard the buffer solution.
 - Unscrew the calibration cup (I).
 - Do **not** return the buffer solution to the supply bottle!
 - Flush the calibration cup (I) with water.
4. Press OK to automatically jump to the menu "buffer value 2".

Buffer 2

1. Select one of the two other buffer values.
2. Fill the calibration cup (I) up to the mark with buffer solution.
3. Screw the calibration cup (I) into the flow armature (F).
4. Press OK to automatically read the measured signal of buffer value 2, and compare it with the buffer values.
 - The calibration result is then displayed:
sensor gradient + asymmetry potential.

CALDATA pH

slope
- 60.17 mV / pH
asymmetry pot.
19 mV

5. Then discard the buffer solution.
 - Unscrew the calibration cup (I).
 - Do **not** return the buffer solution to the supply bottle!
 - Flush the calibration cup (I) with water.
 - Screw the calibration cup (I) into the flow armature (F).

6. Go back to the menu "calibration" with ESC.

Then calibrate the chlorine value!

Calibrating the parameters chlorine, chlorine dioxide and ozone

- DIP: Select the left-hand display for chlorine with the Select button.
1. Select the calibration function with the CAL button. The LED illuminates.
 2. Press OK to select the menu "calibration".
 3. Select "chlorine", and confirm with OK.

chlorine

cal. meas. value

cal result
cal cycle

4. Enter the reference value (for instance the value measured photometrically using DIT).
 - The measured signal is then read in automatically and compared with the reference value.
 - The calibration result is then displayed: sensor gradient.

CALDATA chlorine

slope
34.67 μ A / ppm

Reading calibration data in the diagnostics menu "Service"

- Select "Service" in the MAIN MENU with UP/DOWN, and press OK (on both displays with DIP).
 - The data of the last 10 calibrations can be read.

12.8.3 Calibrating the parameters chlorine, chlorine dioxide or ozone with Conex DIS-D

1. Press the CAL selector, and select the calibration menu.
 - The CAL LED next to the CAL selector illuminates.
 - To prevent overdosing, the controllers must be switched off, and the actuators closed.
 - When the calibration function has been selected with the CAL button, the measured-value display shows the current measured value.
2. Use UP/DOWN to select the photometrically or analytically determined reference value (for instance the value measured photometrically using DIT).
3. Start the calibration with OK.
 - The sensor data are then read in by an automatic read function, and the calibration carried out.
 - The gradient (sensitivity) of the sensor is calculated.
 - The calibration result is displayed immediately after the calibration.
 - The sensor gradient is displayed in μ A/ppm.

Calibration result

- The result of the current (last) calibration can be displayed in the code menu at any time:
 - Code 51: display of calibrated gradient in μ A/ppm.

Error message when reading in the current signal of the sensor system

- The alarm LED flashes.
- The code flashes.

13: Gradient error.

The alarm is triggered if the plausibility check establishes an upward or a downward violation of the following gradient ranges depending on the selected measuring cell:

Measuring cell	Lower limit	Upper limit
AQC-D1	7.0 μ A/ppm	70.0 μ A/ppm

- Press OK to acknowledge the error message and to return to the display level.
 - The calibration data are then imported.

Note

***The instrument is operating in emergency mode!
Eliminate the fault, see section 13.5 Fault finding
chart, and calibrate again!***

13. Operation

13.1 Function

Various oxidation agents are used for the disinfection of swimming-pool water and drinking water, for instance chlorine (Cl_2), chlorine dioxide (ClO_2) and ozone (O_3).

It is necessary to measure the concentration of the oxidation agent and to regulate its dosing for various reasons:

- The disinfection effect is too weak at too low concentrations.
- Too high concentrations have consequences:
 - danger to health
 - unpleasant odour and taste
 - corrosion damage
 - increased operating costs.

The **AQC-D1 potentiostatic measuring cell** is used for measuring the concentration of chlorine (Cl_2), chlorine dioxide (ClO_2) or ozone (O_3) and is equipped with additional holders for pH single-rod electrodes and redox single-rod electrodes, and also for a water sensor and an integrated Pt100 temperature sensor.

The **preassembled system** with Conex DIA, Conex DIS and DIP are used when the values of decontamination agents, pH and redox-potential have to be determined and controlled.

The basic element of the preassembled systems is the AQC-D1 potentiostatic measuring cell.

13.1.1 Functional principle of measurement

- Sample water is taken at a representative position and passed to the measuring cell via an integral filter.
 - The water flow rate can be adjusted on the measuring cell.
 - A water sensor (optional), for example, serves to trigger an alarm or to switch off the control function if there is a sample water deficiency.
 - The agent to be determined (Cl_2 , ClO_2 or O_3) is measured at the noble-metal electrode.
- The material to be determined generates an electric current:
 - in the μA range
 - proportional to the concentration of the parameters Cl_2 , ClO_2 and O_3 .
 - The measuring cell is controlled by a potentiostat integrated into the measuring amplifier.
 - A constant voltage is applied to the measuring electrode. An exactly defined potential of the working electrode is retained by means of the third electrode (reference electrode). This results in a linear response for the measuring cell as well as a stable zero point for the measurement.
- The Conex or DIP measuring amplifiers and controllers
 - amplify the current
 - calculate it using the calibration parameters
 - display the concentration as a digital value
 - control a gas dosing unit or a dosing pump as the device controlled.

13.1.2 Electrode cleaning

The measuring electrode and the counter-electrode are continuously cleaned of deposits by a cleaning wing which has a gentle, yet effective action.

- This ensures uniform sensitivity for the measuring cell over a long period.
- The cleaning motor drives a cleaning wing via a magnetic clutch.

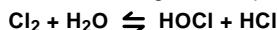
13.1.3 Influence of temperature

The current generated on the electrodes depends on the temperature of the sample water.

- The measured value increases by approx. 4 % per 1°C increase.
- Temperature variations can be compensated for by the measuring amplifier if the temperature compensation function is activated.
 - The temperature can be measured using a Pt100 temperature sensor integrated into the measuring electrode.
 - The temperature measuring signals are transferred to the measuring amplifier and calculated using the electrode signals.

13.1.4 Influence of the pH value on the chlorine measurement

Free, active chlorine is considered as the total of molecular chlorine gas (Cl_2), hypochlorous acid (HOCl) and hypochlorite anions (OCl^-). Dissolved chlorine gas in molecular form practically does not exist at the application-dependent pH values (pH 4.5 to 8.5), but is subject to hydrolysis in the presence of water according to the equation



The resulting hypochlorous acid is the actually effective compound for disinfection of the water. The dissociation of acid to anions is primarily according to an equilibrium dependent on the pH value according to the equation

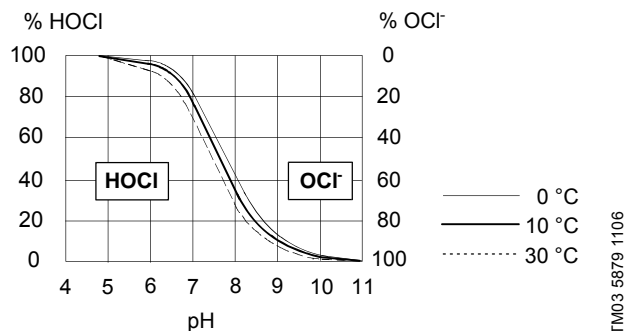
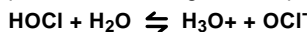


Fig. 27 HOCl-OCl diagram

The potentiostatic measuring cell for chlorine primarily only determines the portion of hypochlorous acid that is relevant for disinfection.

Since the dependence on the pH value is particularly large in the actually relevant range between pH 7 and pH 8.5, this dependence must be compensated for in the measuring amplifier if the pH value varies considerably. The pH value must therefore also be measured, and the pH compensation function must be activated on the measuring amplifier.

13.2 Operation

13.2.1 Switching on

See section [12.7 Switching on](#).

13.2.2 Operating state

Observe the installation and operating

Caution

instructions of the measuring amplifier and the device controlled (for instance a gas dosing unit or dosing pump)!

- The operation of the measuring cell in the operating state can be taken from the installation and operating instructions of the relevant measuring amplifier.

Caution

The measuring cell may be damaged if the reference electrode B1 is not connected, and the electricity supply is switched on!

13.2.3 Adjusting / setting the quantity of sample water

- Set an average quantity of sample water with the adjustment spindle (O1) so that the float body (N) is in the middle of the measuring tube (M).
- When using a water sensor (O, optional): In order for the water sensor (O) to work, the float body (N) must be at the height of the water sensor (O).

Measuring cell with float stopper (default upon delivery): If the sample water flow rate is set too high or is increased temporarily, no alarm is triggered, and the control output remains active!

Caution *If the sample water flow rate is set too high or is increased temporarily, there is a risk that the sample water will overflow at the overflow mechanism. In this state, no alarm is triggered, and the control output remains active!*

Measuring cell without float stopper (see section 12.3.1 Removing the float stopper): If the sample water flow rate is too high, the float body (N) will move outside of the detection range of the water sensor (O). In this state, an alarm is triggered via the connected measuring amplifier, and the control output is switched off, if necessary. The flow rate is set correctly if the float body (N) is at the height of the water sensor (O).

Caution *If the sample water flow rate is too high, the float body (N) will move outside of the detection range of the water sensor (O). In this state, an alarm is triggered via the connected measuring amplifier, and the control output is switched off, if necessary. The flow rate is set correctly if the float body (N) is at the height of the water sensor (O).*

Note *By increasing the sample water flow rate, the delay time of the flow armature can be reduced.*

13.3 Switching off

To avoid a dosing error, the device controlled (for instance a gas dosing unit or dosing pump) must be switched off each time the measuring system is switched off. Observe the installation and operating instructions of the measuring amplifier and device controlled!

Caution *To avoid a dosing error, the device controlled (for instance a gas dosing unit or dosing pump) must be switched off each time the measuring system is switched off. Observe the installation and operating instructions of the measuring amplifier and device controlled!*

13.3.1 Short-term stop (up to one week)

- Close and/or switch off the device controlled (for instance a gas dosing unit or dosing pump).
- Wait until the display of the measuring amplifier is at zero.
- Switch off the measuring amplifier.
- Close the connection to the sample water inlet (U1) and outlet (U2).

To protect the electrodes, do not drain the water! Make sure that the water level in the flow fitting F is sufficiently high for the reference electrode B1 to be immersed at least 2 cm during device stop.

Caution *To protect the electrodes, do not drain the water! Make sure that the water level in the flow fitting F is sufficiently high for the reference electrode B1 to be immersed at least 2 cm during device stop.*

13.3.2 Long-term stop

- Close and/or switch off the device controlled (for instance a gas dosing unit or dosing pump).
- Wait until the display of the measuring amplifier is at zero.
- Switch off the electricity supply to the measuring amplifier and the cleaning motor at all poles.
- Close the connection to the sample water inlet (U1) and outlet (U2).
- Open the deaeration spindle (R1).
- Open the bleeding spindle (L) and deaeration spindle (J), and drain water.
- Close the deaeration spindle again (R1).
- Remove the reference electrode (B1), fit thread protective caps, and clean the electrode.
- Remove the pH (A1) and redox single-rod measuring chains (A2), if necessary. Fit thread protective caps, and clean the electrode.
- Fit protective caps on the electrodes. The protective caps must be filled with 3-molar potassium chloride solution.

Caution *Observe the installation and operating instructions of the electrodes!*

- Store electrodes with protective caps in a dry place. If they are stored for an extended period of time, add a 3-molar potassium chloride solution, if necessary.
- Carefully unscrew the screwed part (H), and empty it of water, if any.

Caution *Carefully remove the screwed part (H)! The cleaning wing (X) and inlet chamber (W) are loose on the measuring electrode (D) and may fall out!*

- Before starting up again, and if it is very dirty, clean the whole flow armature (F). See section 14. Maintenance.

13.4 Switching on again

Observe the installation and operating instructions of the measuring amplifier and device controlled (for instance a gas dosing unit or dosing pump)!

Caution *Observe the installation and operating instructions of the measuring amplifier and device controlled (for instance a gas dosing unit or dosing pump)!*

13.4.1 After short-term stop

Note *Fill the measuring cell with water.*

- Open the connection to the sample water outlet (U2).
- Open the connection to the sample water inlet (U1).
- Check the quantity of sample water.
- Switch on the measuring amplifier.

Caution *Let the system run for at least two hours to avoid faulty measurements and calibrations!*

- Take a photometrical measurement.
- Recalibrate, if necessary. See section 12.8 Calibrating the parameters Cl_2 , ClO_2 , O_3 .
- Switch on the device controlled (for instance a gas dosing unit or dosing pump), if necessary.

13.4.2 After long-term stop / inspection

If the measuring cell has been switched off for a long period of time or has been emptied, for instance for inspection, is it necessary to start up the measuring cell as if it was the first start-up. See section 12.6 Checks prior to start-up and 12.7 Switching on.

13.5 Fault finding chart

Caution

Observe the installation and operating instructions of the measuring amplifier and controller!

Fault	Cause	Remedy
1. No display. No electricity supply to the measuring cell.	a) A disinfection or oxidation agent is missing in sample water.	Check the concentration by making a reference measurement. Check the dosing units, and activate dosing. Check the settings of the measuring amplifier.
	b) The electrode cable connection is interrupted.	Remake the connection. Replace damaged cables.
	c) No or too low sample water flow rate.	Clean the filter, check the flow rate, and check the sample water inlet pressure.
	d) The measuring electrodes are faulty.	Replace the measuring electrode.
	e) The measuring electrodes are contaminated or made passive by deposits.	Dismantle, clean or replace the measuring electrode.
2. The measured value is lower than the reference measurement.	a) The measuring electrodes are faulty.	Replace the measuring electrode.
	b) The measuring electrodes are contaminated or made passive by deposits.	Remove, clean or replace the measuring electrode.
	c) The temperature has fallen since the calibration.	Recalibrate. Activate the automatic temperature compensation, where applicable.
	d) The system has run too short time prior to calibration.	Let the system run for at least two hours, and recalibrate.
	e) Unsuitable chlorination agent.	Only use chlorine solutions such as chloric gas, sodium hypochlorite and chlorinated lime. Do not use organic products such as trichlorine isocyanic acid, as these cannot be measured if this procedure is used.
	f) Incorrect photometric reference measurement during calibration.	Check the reference measurement, and take another measurement. Repeat the calibration.
	g) The pH value for the chlorine measurement has risen since the calibration.	Keep the pH value constant. Recalibrate. Activate the pH value compensation.
	h) The cleaning motor does not run.	Check the power voltage. Replace the cleaning motor, if necessary.
	i) The quantity of sample water is set too low.	Check and set the quantity of sample water. Check the filter, and clean it, if necessary.
	j) The cleaning wing is blocked.	Fit the cleaning wing correctly.
3. The measured value is higher than the reference measurement.	a) The temperature has risen since the calibration.	Recalibrate. Activate the automatic temperature compensation.
	b) The pH value for the chlorine measurement has fallen since the calibration.	Keep the pH value constant. Recalibrate. Activate the pH value compensation, where applicable.
	c) Interference by other oxidation agents in the sample water.	Analyse the sample water. Check the chemicals used.
4. The measured value is unstable.	a) Interferences on the signal lines.	Check the screen and the connections to the amplifier.
	b) The reference electrode diaphragm is blocked.	Clean the diaphragm (on the side at the bottom of the reference electrode) using diluted hydrochloric acid (10 %). Replace the reference electrode, if necessary.
	c) The measuring electrode is contaminated or faulty.	Clean the measuring electrode using a diluted abrasive cleaning agent. Replace the measuring electrode, if necessary.
	d) The filter is contaminated, and the quantity of sample water is therefore too low.	Check the filter, and clean it, if necessary.

14. Maintenance

14.1 Intervals for cleaning and maintenance



Warning

Prior to maintenance work: Switch off the system as described in section 13.3 Switching off!

Make sure that the mains is switched at all poles!

- Clean the filter
 - if high contamination is evident, or if the pressure drops considerably.
- Clean the whole flow armature
 - if high (visible) contamination is evident.
 - if faults occur.
 - before starting up again after a prolonged stoppage.
- Replace the electrodes.
 - Grundfos Alldos recommends that you replace the reference electrode and, if necessary, the redox or pH single-rod electrode after 12 months.
 - The measuring electrode is wear-resistant and does not have to be replaced on a regular basis.

Note

When cleaning the measuring electrode, do not unscrew it from the cleaning motor!

14.2 Cleaning and replacing the filter

- Required tools and aids:
 - water
 - soft brush.
1. Close the connection to the sample water inlet (U1) and outlet (U2).
 2. Unscrew the filter cartridge (P).
 3. Unscrew the plastic screw thread (P1) at the upper end of the filter cartridge (P), using a screwdriver or coin, if necessary.
 4. Remove the filter strainer (P2) from the filter receptacle (P3), and clean it under running water. Use a soft brush, if necessary.
 5. If damaged: Replace the filter strainer (P2).
 6. Re-assemble the filter cartridge (P) in reverse order.
 7. Check the tightness of the filter cartridge (P).

Note

After cleaning, check the sample water flow rate, and adjust it, if necessary.

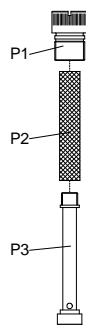


Fig. 28 Filter

14.3 Cleaning the flow armature

14.3.1 Removing the measuring cell

Caution

The measuring cell must only be removed by authorised personnel.

1. Close the water inlet, and switch off the measuring cell.
 - Close the shut-off spindles of the sample water inlet (V1) and outlet (V2).
 - Close and/or switch off the device controlled (for instance a gas dosing unit or dosing pump).
 - Wait until the display of the measuring amplifier is at zero.
 - Switch off the electricity supply to the measuring amplifier and cleaning motor.

2. Empty the measuring cell.
 - Open the deaeration spindle (R1).
 - Open the bleeding spindle (L) and deaeration spindle (J), and drain the water.
 - Close the deaeration spindle again (R1).
 - Unscrew the connections to the sample water inlet (U1) and outlet (U2).
3. Remove the electrodes and sensors.
 - If a water sensor is fitted: Unscrew the screw (O1) on the water sensor (O), and remove the sensor.
 - Unscrew the plug for the measuring electrode (E), and remove the electrode.
 - Remove the reference electrode (B1). Fit thread protective caps, and clean the electrode.
 - Remove the pH (A1) and redox electrodes (A2), if necessary. Fit thread protective caps, and clean the electrodes.
 - Fit protective caps on the electrodes. The protective caps must be filled with 3-molar potassium chloride solution.

Caution

Observe the installation and operating instructions of the electrodes!

- Store electrodes with protective caps in a dry place.

Carefully remove the screwed part (H)! The cleaning wing (X) and inlet chamber (W) are loose on the measuring electrode (D) and may fall out! Keep O-rings!

Note

4. Unscrew the cleaning motor and measuring electrode.
 - Unscrew the cleaning motor (G) and the screwed part (H) from the flow armature (F) with the slide (G1), and remove them carefully.
 - Keep O-rings (W1).
 - Remove the cleaning wing (X) and inlet chamber (W).
5. Remove the flow armature.
 - Slacken the screws of the flow armature (do not unscrew completely), press the flow armature upwards, and remove it from the mounting plate.

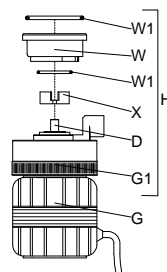


Fig. 29 Exploded view of screwed part

14.3.2 Dismantling the measuring cell

1. Remove the screw plug (R) and deaeration spindle (R1), and separate them.
 - Do not remove the plug from either of the two holes under the screw plug!
2. Remove the sample water regulating device and float body.
 - Remove the valve insert (Q2) and adjusting spindle (Q1), and separate them.
 - Remove the float body (N).
3. Remove the filter.
 - Unscrew the filter cartridge (P).
 - Slacken the screw cap for the filter (P1) at the upper end of the filter cartridge (P).
 - Remove the filter strainer (P2) from the filter receptacle (P3).
4. Remove the calibration cup and evacuation spindle.
 - Remove the calibration cup (I) and evacuation spindle (J), and separate them.

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5. Remove the shut-off spindles and the bleeding spindle.
 - Unscrew the shut-off spindles of the sample water inlet (V1) and outlet (V2) and the bleeding spindle (L).

14.3.3 Cleaning the measuring cell

- Required tools and aids:
 - soap suds, possibly diluted hydrochloric acid (5-10 %), water
 - abrasive domestic cleaning agent (for instance ATA, VIM).
 - The flow armature (F) can be cleaned with conventional soap suds.
 - If high contamination or furring is evident, clean the dismantled flow armature (F) briefly with diluted hydrochloric acid (max. 5-10 %).



Warning

Observe the safety regulations when using hydrochloric acid! When cleaning with hydrochloric acid it is absolutely necessary to wear safety goggles.

Caution

Before using other detergents, check the chemical resistance of the materials, as they may destroy some components.

Caution

Do not clean electrodes, filters, float bodies or other metal parts using hydrochloric acid.

1. Clean the metal surfaces of the measuring electrode (D) and the float body (N) with an abrasive domestic cleaning agent if there are deposits.
2. Clean the filter strainer (P2) under running water. Use a soft brush, if necessary.
3. Carefully clean all plastic parts with soap suds.
4. Use hydrochloric acid (5-10 %) for deposits.
5. Carefully rinse all parts with clean water.
6. Replace any damaged parts.

14.4 Assembling the measuring cell

Caution

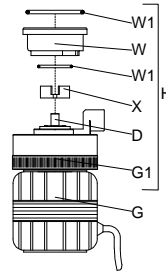
Only tighten screw parts by hand; do not use tools! Risk of leaking! Ensure that all O-rings are fitted correctly!

1. Re-assemble the measuring cell in reverse order.
 - Screw in the shut-off spindles of the sample water inlet (V1) and outlet (V2) and the bleeding spindle (L).
 - Assemble and screw in the calibration cup (I) and evacuation spindle (J).
 - Assemble and screw in the filter cartridge (P).
 - Insert the float body (N) with the sharp end facing downwards into the measuring tube (M).
 - Tightly screw in the valve insert (Q2), and screw in the adjusting spindle (Q1).
 - Screw in the screw plug (R) and the deaeration spindle (R1) (the plug under the screw plug must be inserted!).
2. Screw the flow armature onto the unit.
 - Hook the flow armature (F) onto the screws of the mounting plate, and pull it downwards. Screw in the screws of the flow armature (F).

Caution

The measuring cell breaks when the screws are tightened! Do not tighten the screws; only screw them in without tightening them.

3. Screw in the cleaning motor and measuring electrode.
 - Fit the cleaning wing (X) and inlet chamber (W) with both O-rings (W1) on the measuring electrode.
 - Place the cleaning wing (X) with the larger surface area downwards.
 - Rotate the inlet chamber (W) until it engages with the electrode in the defined position.
 - Screw the cleaning motor (G) and the screwed part (H) with the slide (G1) onto the flow armature (F).

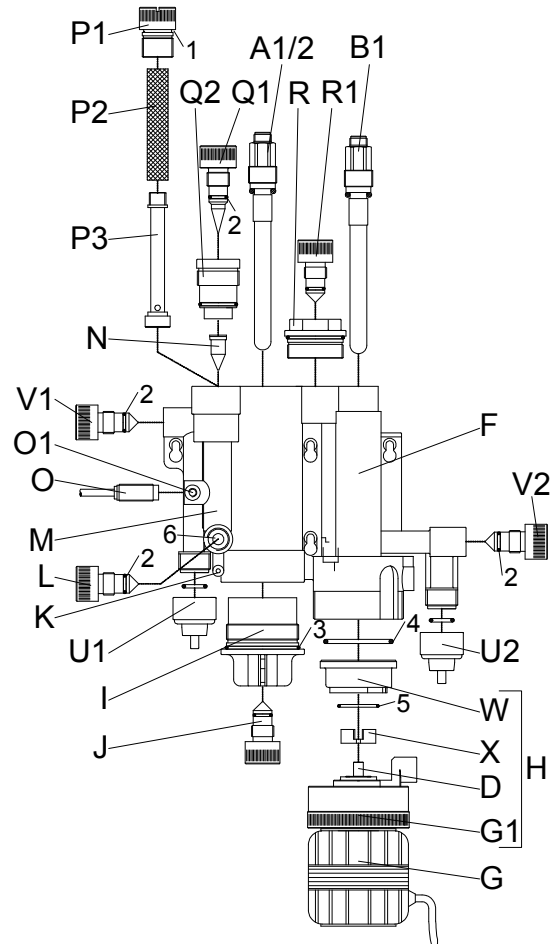


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TM03 5682 1106

Fig. 30 Exploded view of screwed part / inlet chamber



TM03 5683 1106

Fig. 31 Exploded view of AQC-D1

15. Starting up the measuring cell

See section [12. Start-up](#).

16. Spare parts and accessories

16.1 Electrodes, sensors and cables

Product number	Component
96609182 (321-252)	Cable for reference electrode, pH or redox single-rod electrode, 1 m
96609183 (321-250)	Cable for reference electrode, pH or redox single-rod electrode, 3 m
96609184 (321-140)	Cable for measuring electrode, 1 m
96609185 (321-141)	Cable for measuring electrode, 3 m
96609172 (45.10212-1)	Water sensor with cable, 1 m
96609173 (45.10212)	Water sensor with cable, 3 m
96609174 (314-605)	Reference electrode
96609175 (553-1561)	Measuring electrode, gold
96609176 (553-1562)	Measuring electrode, platinum
96609158 (312-100)	Single-rod measuring cell pH (standard)
96609162 (313-100)	Single-rod measuring cell redox (standard)
96622944 (313-105)	Redox electrode (in combination with DIP only)
96609181 (553-1564)	Cleaning wing

16.2 Other parts

Product number	Component
96609171 (553-1529)	Spare parts set
	Pos. Designation Quantity
	1 O-ring 20 x 2 1
	2 O-ring 10 x 2 4
	3 O-ring 50 x 2 1
	4 O-ring 45 x 3 1
	5 O-ring 26 x 2 1
96624812 (553-1593)	6 O-ring 8.3 x 2.4 1
	Screw plug with O-ring for holder A (pH or redox single-rod measuring electrode)
91834713 (12.4568)	Filter strainer (P2)
96609179 (12.6459-400)	Pressure-loading valve (V)

17. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use appropriate waste collection services.
2. If this is not possible, contact the nearest Grundfos or Grundfos Alldos company or service workshop.

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Grundfos Alldos

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SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.14 Chlorine Analyzer-Grundfos

Model # Grundfos Conex DIA-2

Tag # AIT-316

GRUNDFOS ALLDOS INSTRUCTIONS

Conex[®] DIA-2

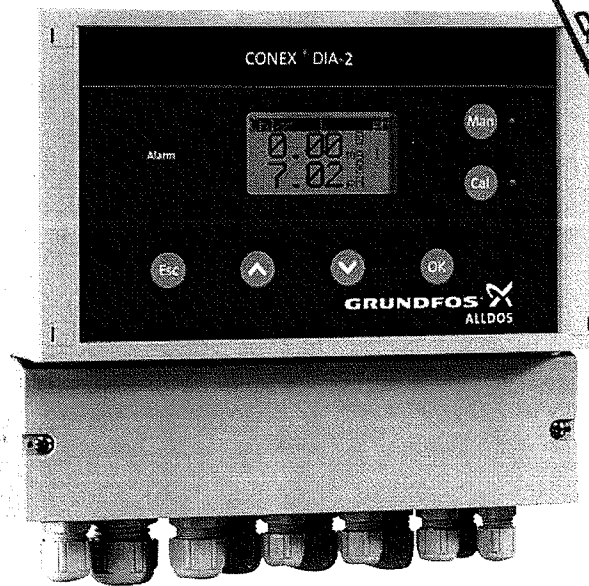
Instrument amplifier and controller

(GB) Installation and operating instructions

REVIEWED ACCORDING TO THE
REQUIREMENTS OF THE GENERAL
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THESE
REQUIREMENTS.

☒ REVIEWED
☐ MAKE NOTED CORRECTIONS
☐ REVISE & RESUBMIT

DATE: Dec 9, 2010 BY: K.B.

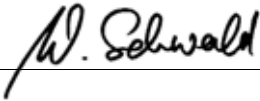


Declaration of Conformity

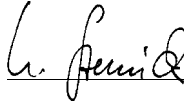
We **Grundfos Alldos** declare under our sole responsibility that the product **Conex® DIA-2**, to which this declaration relates, is in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to

- Electromagnetic compatibility (89/336/EEC).
Standards used:
EN 61000-3-2: 1995 + A1 + A2: 1998,
EN 61000-3-3: 1995,
EN 61326: 1997 + A1: 1998 + A2: 2001 Class B,
EN 61326: 1997 / A1: 1998 + A2: 2001.
- Electrical equipment designed for use within certain voltage limits (73/23/EEC) [95].
Standard used: EN 61010-1: 2002.

Pfinztal, 15th April 2008



W. Schwald
Managing Director



Ulrich Sternick
Technical Director

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Warning

These complete installation and operating instructions are also available on www.Grundfosalldos.com.



Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning



If these safety instructions are not observed, it may result in personal injury!

Caution

If these safety instructions are not observed, it may result in malfunction or damage to the equipment!

Note

Notes or instructions that make the job easier and ensure safe operation.

2. A few words in advance

The **Conex® DIA-2** (Dosing Instrumentation Advanced with 2 inputs) multipurpose measuring amplifier and controller you have just purchased uses the company's leading-edge measuring technology.

The **Conex® DIA-2** is a multipurpose device designed to carry out high-precision measurements and controls of the following:

- a value from parameter group 1:
 - chlorine, chlorine dioxide, ozone or hydrogen peroxide
- a value from parameter group 2:
 - pH value.

The integrated controller, the high-resolution graphics display and the multilingual plain-text user interface make complicated measuring and control tasks in water chemistry much easier.

Just a few button inputs lead you to your goal. The potentiostat helps save even more time, being automatically matched to the various input variables.

The safety standard of the dosing process is raised by the automatic open-circuit monitoring of the current outputs.

Properties of the **Conex® DIA-2** measuring amplifier and controller include the following:

- all control functions including PID and continuous-action controls
- setpoint control
- manual or automatic temperature compensation
- logbook function: chronological recording of calibration values with date and time
- user coding function as a means of protection against access by unauthorised persons and for system administration
- error message function for indication of non-functioning sensors.

3. Installation data

Please fill in the data below after commissioning. It will help you and your Grundfos Alldos service partner make subsequent adjustments to the installation.

Note

Owner:

Grundfos Alldos customer number:

Order number:

Product number:

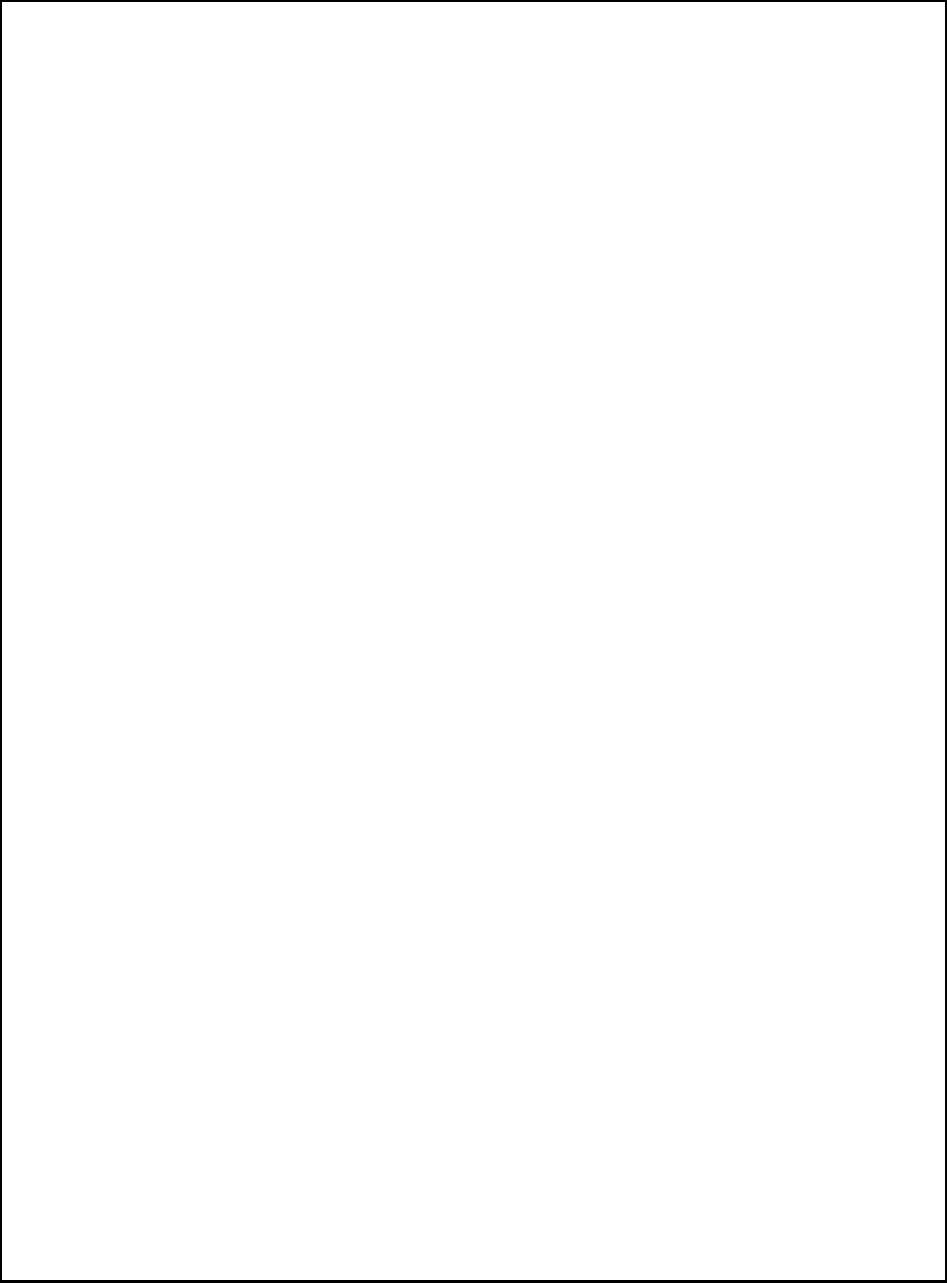
Product serial number:

Put into service on:

Location of product:

Used for:

4. Installation sketch



5. Instrument settings

Parameter 1			
Setup		Controller	Alarm
Parameter	Controller	Proportional Xp %	Alarm On:_ Off:_ Alarm value 1 Switching point
Chlorine:_ Chlorine dioxide:_ Ozone:_ Peroxide:_ Temp. meas. Yes:_ No:_ Temp. comp. Yes:_ No:_ pH compensation Yes:_ No:_ Measuring ranges mg/l (ppm) Current output 1 mA Measuring cell Measuring cell type Cleaning motor Monitoring on:_ Monitoring off:_ Water sensor On:_ Off:_ 	Setpoint ctrl. Off:_ Limit:_ Interpulse ctrl.:_ Pulse freq. ctrl.:_ Cont. controller:_ Limit contact Downward viol.:_ Upward violation:_ Ctrl. direction Downward control:_ Upward control:_ Type of control P:_ PI:_ PID:_ 	Reset time TN (PI/PID control) sec. Deriv. action Tv (PID control) sec. Int.pulse period (interpulse ctrl.) sec. Min. ON time (interpulse ctrl.) sec. Max. frequency (pulse freq. ctrl) n/min Setpoint (limit contact) Constant load % Max. dosing flow % Limit (limit contact) Hysteresis (limit contact)	Alarm value 1 Switching direction Upward violation:_ Downward viol.:_ Alarm value 2 Switching point Alarm value 2 Switching direction Upward violation:_ Downward viol.:_ Hysteresis Alarm delay sec. Dos. time monit. On:_ Off:_ Dos. time monit. Max. dosing time min

Parameter 2				
Setup		Controller	Alarm	
Parameter	Controller	Proportional Xp %	Alarm On: __ Off: __	
pH	Setpoint contrl. Off: __ Limit: __ Interpulse ctrl: __ Pulse freq. ctrl: __ Cont. controller: __	Reset time TN (PI/PID control) sec.	Alarm value 1 Switching point	
Temp. meas. Yes: __ No: __	Limit contact Downward viol.: __ Upward violation: __	Deriv. action TV (PID control) sec.	Alarm value 1 Switching direction Upward violation: __ Downward viol.: __	
Temp. comp. Yes: __ No: __	Control direction Downward control: __ Upward control: __	Int.pulse period (interpulse ctrl.) sec.	Alarm value 2 Switching point	
pH compensation Yes: __ No: __	Type of control P: __ PI: __ PID: __	Min. ON time (interpulse ctrl.) sec.	Alarm value 2 Switching direction Upward violation: __ Downward viol.: __	
Measuring ranges mg/l (ppm)		Max. frequency (pulse freq. ctrl) n/min	Hysteresis	
Current output 1 mA		Setpoint (limit contact)	Alarm delay sec.	
		Constant load %	Dos. time monit. On: __ Off: __	
		Max. dosing flow %	Dos. time monit. Max. dosing time min	
		Limit (limit contact)		
		Hysteresis (limit contact)		

6. General information

These installation and operating instructions contain all information important for users of the **Conex® DIA-2**:

- technical data
- instructions on commissioning, use and maintenance
- safety information.

Should you require further information or should you encounter problems that are not handled in sufficient depth in this manual, please contact Grundfos Alldos. We shall be pleased to support you with our comprehensive know-how in the fields of measuring and control technology as well as water treatment.

We always welcome suggestions on how to optimise our installation and operating instructions to satisfy our customers.

6.1 Warranty

A warranty claim in accordance with our general terms of sale and delivery is only valid if these requirements are complied with:

- The device has been used in accordance with the information in this manual.

The device has not been dismantled or handled incorrectly.

7. Applications

The **Conex® DIA-2** instrument amplifier and controller is suitable for measuring chlorine (Cl_2), chlorine dioxide (ClO_2), ozone (O_3), hydrogen peroxide (H_2O_2) and pH and for controlling these variables using appropriate actuators within the applications described in this manual.



Warning

Other applications are not approved and not permitted. Grundfos Alldos cannot be held liable for any damage resulting from incorrect use.

8. Safety

8.1 Obligations of the owner/operations manager

The owner/operations manager must ensure that persons working with the **Conex® DIA-2** instrument amplifier and controller fulfil these requirements:

- They are acquainted with the regulations concerning working safety and accident prevention.
- They have been trained in use of the device.
- They have read and understood the warning information and handling symbols.

The owner/operations manager is also responsible for ensuring that this manual is kept in the immediate vicinity of the device and is always available for the operating personnel.

8.2 Avoidance of danger



Warning

Installation and connection of the device and the associated supplementary components must only be carried out by authorised personnel! The local safety regulations must be observed!



Warning

Switch off the power supply before connecting the power supply cable and relay contacts!

Do not dismantle the device! Maintenance and repair must only be carried out by authorised personnel!

Caution

The mounting location must be selected so that the housing is not subjected to mechanical loading. Check that all settings are correct before starting up the device!

9. Identification

9.1 Nameplate

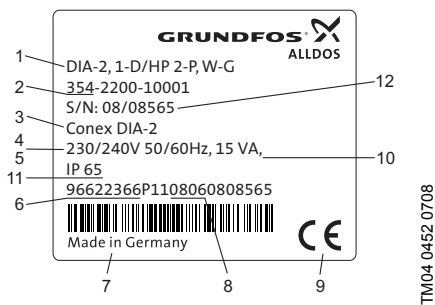


Fig. 1 Nameplate, Conex® DIA-2

Pos.	Description
1	Type designation
2	Model
3	Product name
4	Voltage [V]
5	Frequency [Hz]
6	Product number
7	Country of origin
8	Year and week of production
9	Marks of approval, CE mark, etc.
10	Power consumption [VA]
11	Enclosure class
12	Serial number

9.2 Type key, Conex® DIA-2 controllers

Type key example: DIA-2, 1-D/HP 2-P, W-G

Example:		DIA	-2	1-D/HP	2-P	-W	-G
Measuring amplifier and controller							
DIA-2	Dosing Instrumentation Advanced with 2 inputs						
Input parameter 1							
D	Chlorine (Cl ₂), chlorine dioxide (ClO ₂) or ozone (O ₃)						
HP	Hydrogen peroxide (H ₂ O ₂)						
Input parameter 2							
P	pH						
Mounting							
W	Wall-mounted						
P	Panel-mounted						
Voltage							
G	1 x 230 V, 50/60 Hz						
H	1 x 120 V, 50/60 Hz						
I	24 VDC						

9.3 Type key, Conex® DIA-2 preassembled systems

Type key example: DIA-2-A, D1-P-PT-PCB-QS-T, W-G

Example:		DIA	-2	-A	D1	-P	-PT	-PCB	-QS	-T	W	-G
Units for measurement and control												
DIA-2	Dosing Instrumentation Advanced, with 2 inputs											
Assembly												
A	Preassembled											
Cell type												
D1	Pressure-proof, with cleaning motor											
D2	Pressure-proof, with hydro-mechanical cleaning											
D3	Pressureless, with hydro-mechanical cleaning											
D4	For total chlorine measurement											
D5	For free chlorine measurement with buffer dosing											
P/R	pH or redox (ORP) only											
P	With pressure retention valve											
X	Without pressure retention valve											
Disinfection electrodes												
AU	Gold											
PT	Platinum											
X	No disinfection measuring											
Other electrodes												
PCB	pH, ceramic diaphragm, incl. buffer solution											
PTB	pH, PTFE diaphragm, incl. buffer solution											
PKB	pH, KCl filling, incl. buffer solution											
PGB	pH, gel filling incl. buffer solution											
PCX	pH, ceramic diaphragm, excl. buffer solution											
PTX	pH, PTFE diaphragm, excl. buffer solution											
PKX	pH, KCL filling, excl. buffer solution											
PGX	pH, gel filling, excl. buffer solution											
X	No electrode											
Flow sensor												
QS	Flow sensor integrated											
X	No flow sensor											
Temperature sensor												
T	With Pt100											
X	No temperature sensor											
Mounting												
W	Wall-mounted											
P	Panel-mounted											
Voltage												
G	1 x 230 V, 50/60 Hz											
H	1 x 120 V, 50/60 Hz											
I	24 VDC											

10. Technical data

10.1 Design / enclosure class

Wall-mounted enclosure (distance from sensors up to three metres)	IP65
Control panel enclosure including separate potentiostat	IP54 (front) / IP65 (sensor interface) (distance from sensor interface up to 100 metres, distance from sensor interface to sensors up to three metres)

10.2 General data

Input power	Approximately 15 VA
Permissible ambient temperature	0 °C to +50 °C
Permissible storage temperature	–20 °C to +65 °C
Maximum relative humidity	90 % (non-condensing)
Weight	1.5 kg
Enclosure	Plastic (control panel enclosure: noryl, wall-mounted enclosure: ABS)
Power supply versions	<ul style="list-style-type: none"> • 230/240 V (50/60 Hz) (standard model) • 115/120 V (50/60 Hz) • 24 V DC

10.3 Electronic data and functions

10.3.1 Electronics

Electronics	16-bit microprocessor
Display	High-resolution graphics LCD with background light
Potential-free relay outputs	1 alarm relay, 2 controller relays (250 V/6 A, maximum 550 VA)
Signal inputs	Controller stop; water sensor
Signal outputs	4 analog outputs 0/4 to 20 mA, freely adjustable, maximum load 500 Ω <ul style="list-style-type: none"> • Parameter group 1: chlorine, chlorine dioxide, ozone or peroxide • Parameter group 2: pH • For temperature or continuous control (0/4 to 20 mA) of the parameters from group 2 (pH) • For continuous control (0/4 to 20 mA) of the parameters from group 1 (chlorine, chlorine dioxide, ozone or peroxide)

Freely adjustable analog outputs for measured values

10.3.2 Functions of the instrument amplifier

Display mode	Measured-value display: measured value with its unit, temperature display: in °C or °F
Temperature compensation	Manual or automatic with Pt100 (–5 °C to +120 °C)
Calibration	Manual, or with automatic recognition of buffer solution

10.3.3 Setpoint controller functions

Controller output	Limit monitor, interpulse controller (P, PI, PID), pulse frequency controller (P, PI, PID), continuous controller (P, PI, PID)	Derivative action time T_v	0 to 1000 seconds, resolution one second (only with PID controller)
Limit	0 to 100 % of measuring range, adjustable in the unit of the measured value (only with limit monitor)	Interpulse period	1 to 100 seconds (only with interpulse controller)
Hysteresis	0 to 50 % of full-scale value, adjustable in the unit of the measured value (only with limit monitor)	Minimum ON time T_{min}	0.1 to 10.0 seconds (only with interpulse controller)
Setpoint input	0 to 100 % of measuring range, adjustable in the unit of the measured value	Maximum frequency	1 to 180 pulses per minute (only with pulse frequency controller)
Proportional band X_p	0.1 to 3000.0 %	Basic load	0 to 50 % of dosing rate
Reset time T_n	1 to 3000 seconds, resolution 1 second (only with PI, PID controllers)	Maximum dosing rate	Value (basic load + 1) to 100 % of dosing rate
		Control direction	Adjustable to upward or downward control
		Controller stop	Adjustable to NC or NO

10.4 Measuring ranges

Cl_2	ClO_2	O_3	H_2O_2	pH
mg/l	mg/l	mg/l	mg/l	pH
0.00 - 0.50	0.00 - 0.50	0.00 - 0.50	0-100	0.00 - 14.00
0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0-500	2.00 - 12.00
0.00 - 2.00	0.00 - 2.00	0.00 - 2.00	0-1000	5.00 - 9.00
0.00 - 5.00	0.00 - 5.00	0.00 - 5.00	0-2000	
0.00 - 10.00	0.00 - 10.00			
0.00 - 20.00				

Note

The measuring ranges are also freely adjustable (within the above-mentioned range limits). In the case of chlorine and chlorine dioxide, the free adjustment of the measuring range can be extended up to a maximum of 50.0 mg/l.

10.5 Dimensions

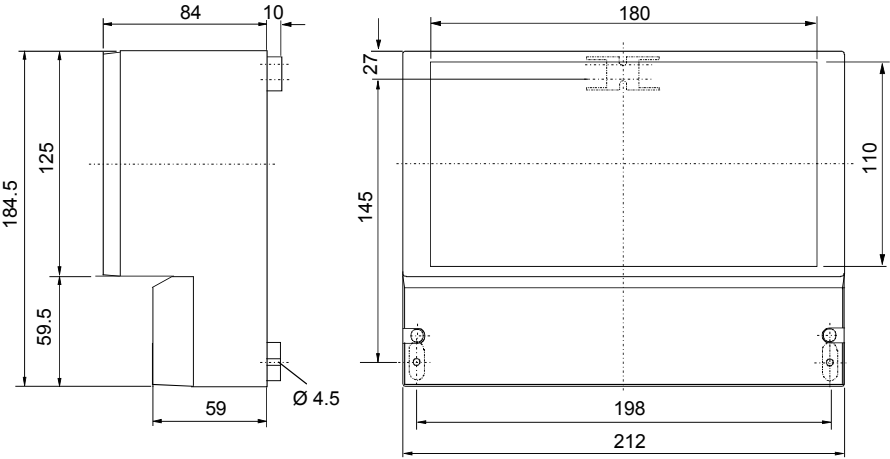


Fig. 2 Wall-mounted enclosure Conex® DIA-2

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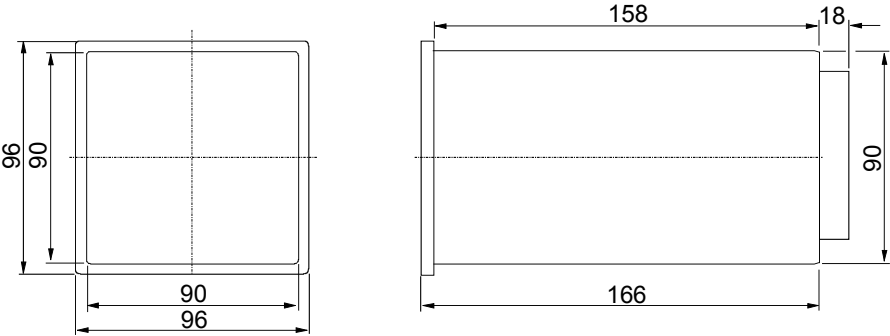


Fig. 3 Control panel enclosure Conex® DIA-2

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11. Installation

11.1 Transport and storage

- Transport the device carefully, do not drop!
- Store at dry and cool location.

11.2 Unpacking

1. Check the device for damage.
Install as soon as possible after unpacking.
2. Do not install or connect damaged devices!

Note

Retain the packing material or dispose of it according to local regulations.

11.3 Installation requirements

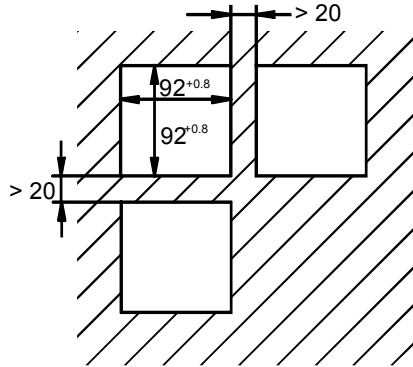
- Dry room
- Room temperature: 0 °C to 50 °C
- Vibration-free location.

If you do not observe the installation requirements, the device may be damaged!

Caution

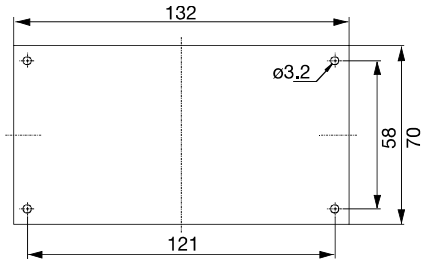
The measurements may not be correct!

11.4 Installation in control panel



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Fig. 4 Control panel enclosure Conex® DIA-2



TM03 6690 4506

Fig. 5 Sensor interface

1. Make an opening of $92 + 0.8 \text{ mm} \times 92 + 0.8 \text{ mm}$ in the control panel.
2. Slip on the supplied gasket.
3. Insert the **Conex® DIA-2** into the opening from the front.

Caution

Do not damage the gasket!

The gasket must be fitted exactly!

1. Hook the clamps into the tightening cones on the sides at the top and bottom.
2. Secure the device from the rear using a screwdriver.
3. Install a separate sensor interface near the sensors (maximum distance of three metres).

11.5 Installation of wall-mounted enclosure

Warning

Switch off the power supply before installing!



Enclosure class IP65 is only guaranteed if the terminal cover is correctly sealed, if the front panel of the terminal enclosure is closed and the appropriate cable glands or dummy caps fitted.

Caution

Do not damage the terminal cover gasket! The terminal cover gasket must fit exactly!

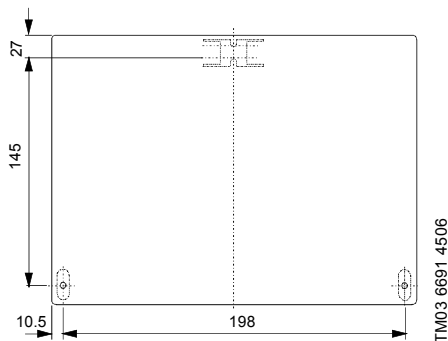


Fig. 6 Wall-mounted enclosure Conex® DIA-2

1. Drill three holes ($\varnothing 8$ mm) as shown in the diagram, and insert the supplied dowels.
2. Screw the screw (A) into the top centre dowel until it projects by approximately 1 cm. See fig. 6.
3. Loosen the fastening screws of the front panel, and remove the front panel.
4. Hang the instrument onto the screw (A).
5. Tighten the instrument with the two screws (B).
6. Mount the front panel of the enclosure.

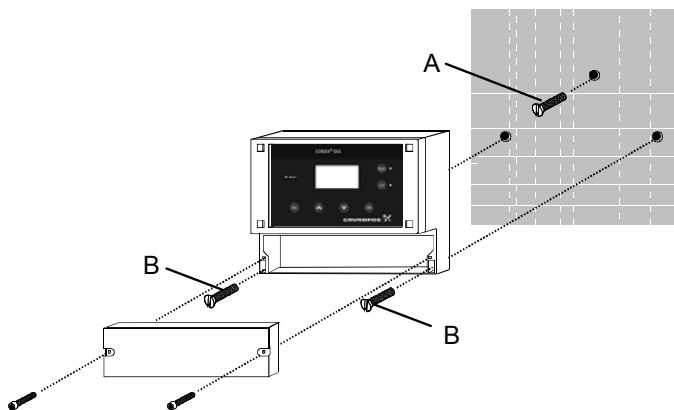


Fig. 7 Mounting drawing

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TM03 6692 4506

12. Commissioning / electrical connections

Warning

Switch off the power supply before installing!



Enclosure class IP65 is only guaranteed with the front panel of the terminals enclosure closed and with appropriate cable glands or dummy caps.

Warning

Switch off the power supply before connecting the power supply cable and relay contacts! For safety reasons, the protective conductor must be connected correctly!



Observe the local safety regulations! Protect the cable connections and plugs from corrosion and moisture.

Before connecting the power supply cable, check that the supply voltage specified on the nameplate corresponds to the local conditions! An incorrect supply voltage may destroy the device!

Caution

To guarantee electromagnetic compatibility (EMC), the input and current output cables must be screened.

Connect the screening to the screen ground on one side.

Refer to the wiring diagram! Route the input, current output and power supply cables in separate cable channels.

Enclosure class IP65 is only guaranteed if the terminal cover is correctly sealed! Do not damage the gasket on the terminal cover!

Caution

The gasket on the terminal cover must be positioned precisely! Do not damage the gasket!

Note

Unused terminals must remain open.

1. Remove the terminal cover on the front of the device.
2. Use the appropriate cable feedthroughs and tighten the screws carefully.
3. Connect the cables used to the terminals according to the **Conex® DIA-2** terminal assignment.
4. Close the terminal cover again with correctly positioned gasket.

12.1 Terminals

12.1.1 Wall-mounted enclosure Conex® DIA-2

Fig. 8 Terminals of wall-mounted enclosure

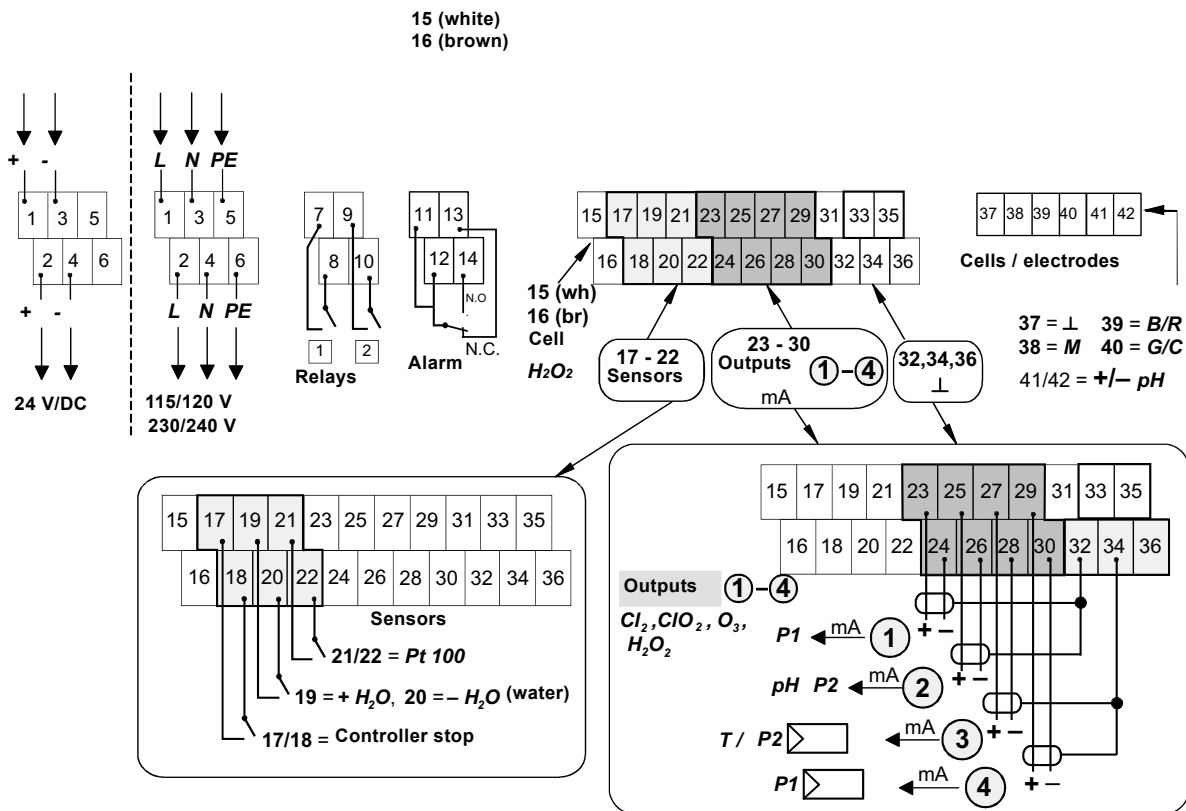
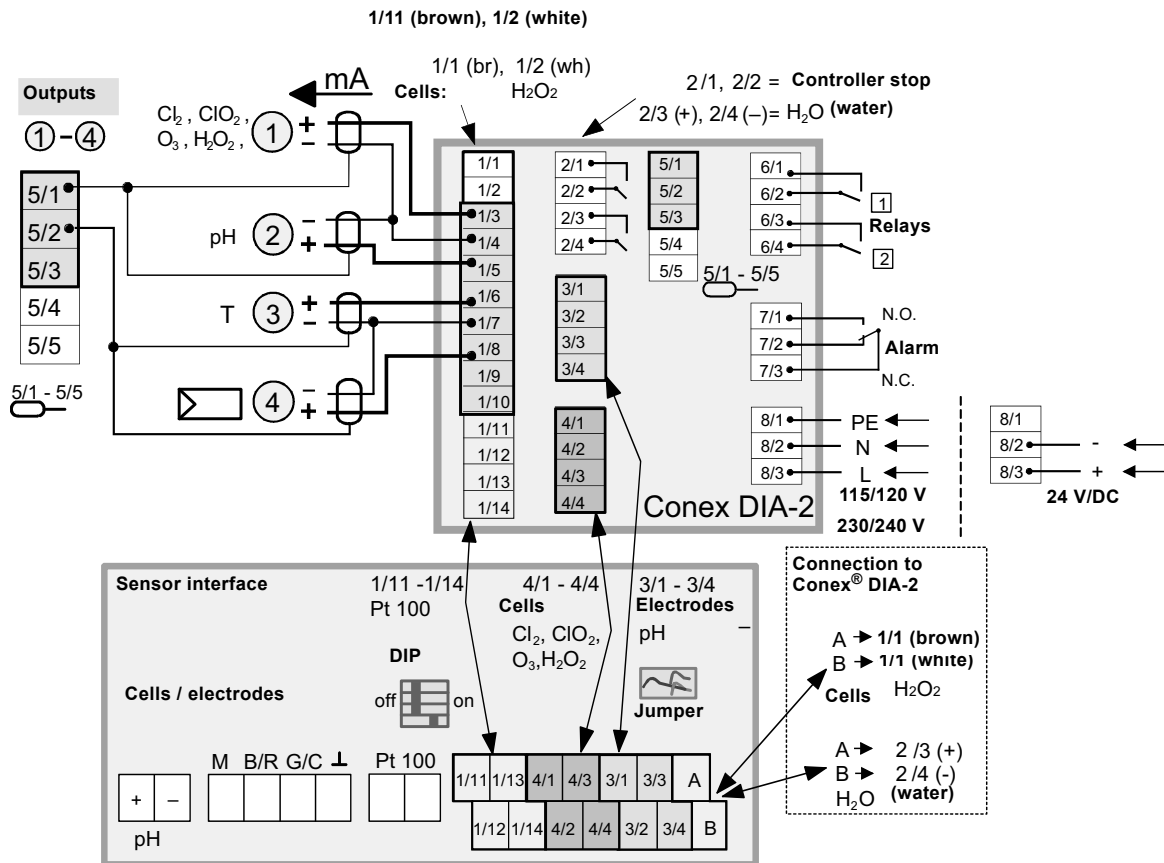


Fig. 9 Terminals of control panel enclosure



Legend of terminals

Pos.	Description
Relays	Relay 1 + 2
Alarm	Alarm relay – N.O.: normally open – N.C.: normally closed
Pt100	Temperature sensor
H ₂ O	Water sensor
Stop	Controller stop (NO or NC selectable)
Outputs	Current outputs [mA]
1	Cl ₂ (chlorine), ClO ₂ (chlorine dioxide), O ₃ (ozone) or H ₂ O ₂ (hydrogen peroxide)
2	pH
3	T/P2: temperature / continuous controller parameter 2
4	P1: output of continuous controller parameter 1
Electrodes	Measuring cells, electrodes and single-rod measuring chains
M	Measuring electrode
B/R	Reference electrode
G/C	Counter electrode
Earth	
mV	pH electrode
screen	

Control panel enclosure Conex® DIA-2

- **Conex® DIA-2:** for installation in the control panel.
- Sensor interface: for installation near the sensors.

12.2 Power supply connection

1. Control panel enclosure: Plug the plug strip into the corresponding terminal strip at the rear side of the device. Ensure correct orientation.
2. Connect the protective earth conductor (PE) to terminal 5 (wall-mounted enclosure) or terminal 8/1 (control panel enclosure).
3. Connect the neutral conductor (N) (or the - conductor with 24 V version) to terminal 3 (wall-mounted enclosure) or terminal 8/2 (control panel enclosure).
4. Connect phase (L1) (or the + conductor with 24 V version) to terminal 1 (wall-mounted enclosure) or 8/3 (control panel enclosure).

Switch the device on and off by switching the power supply on and off accordingly. The device itself is not equipped with a separate on/off switch.

12.3 Relay outputs

The connection of the relay outputs depends on the application and the final control elements used. Therefore the connections described below should only be considered as guidelines.

Note

With inductive loads (also relays and contactors), interference suppression is necessary. If this is not possible, protect the relay contacts using a suppressor circuit as described below.

- With AC voltage:

Current up to	Capacitor C	Resistor R
60 mA	10 nF, 275 V	390 Ω, 2 W
70 mA	47 nF, 275 V	22 Ω, 2 W
150 mA	100 nF, 275 V	47 Ω, 2 W
1.0 A	220 nF, 275 V	47 Ω, 2 W

- With DC voltage: Connect the free-wheeling diode in parallel to relay or contactor.

Caution **Provide the relay outputs with a corresponding backup fuse!**

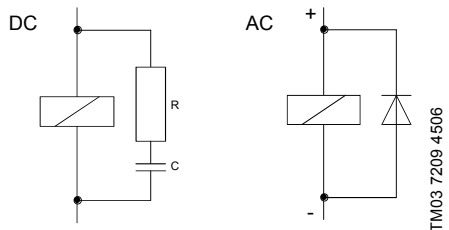


Fig. 10 Suppressor circuit, DC/AC

12.4 Current output

Caution *Make sure that the polarity of the current output is correct!*

Maximum load: 500 Ω .

The current output can be set to one of the two standard ranges "0-20 mA" or "4-20 mA", or it can be freely adjusted.

- Connect the screen to earth (PE) at one end.

Output 1: chlorine, chlorine dioxide, ozone, hydrogen peroxide (parameter 1)

This current output shows the displayed measured value as an analog current signal.

Use of current signal for measured values:

- as input signal for another indicator
 - as input signal for an external controller.
1. Connect the + conductor to terminal 23 (wall-mounted enclosure) or terminal 1/3 (control panel enclosure).
 2. Connect the – conductor to terminal 24 (wall-mounted enclosure) or terminal 1/4 (control panel enclosure).

Output 2: pH (parameter 2)

This current output shows the displayed measured value as an analog current signal.

Use of current signal for measured values:

- as input signal for another indicator
 - as input signal for an external controller.
1. Connect the + conductor to terminal 25 (wall-mounted enclosure) or terminal 1/5 (control panel enclosure).
 2. Connect the – conductor to terminal 26 (wall-mounted enclosure) or terminal 1/4 (control panel enclosure).

Output 3: continuous controller parameter 2 (or temperature)

Shows the calculated actuating variable signal of the controller as an analog current signal.

Use of actuating variable signal:

- as input signal for a final control element with current input

or temperature output:

Shows the temperature measured by the optional temperature sensor as an analog current signal.

Use of temperature current signal:

- as input signal for another indicator.
1. Connect the + conductor to terminal 27 (wall-mounted enclosure) or terminal 1/6 (control panel enclosure).
 2. Connect the – conductor to terminal 28 (wall-mounted enclosure) or terminal 1/7 (control panel enclosure).

Output 4: continuous control parameter 1

This current output shows the calculated actuating variable signal as an analog current signal.

Use of actuating variable signal:

- as input signal for a continuous final control element.
1. Connect the + conductor to terminal 29 (wall-mounted enclosure) or terminal 1/8 (control panel enclosure).
 2. Connect the – conductor to terminal 30 (wall-mounted enclosure) or terminal 1/7 (control panel enclosure).

12.5 Connections of controller stop, sample-water sensor and temperature sensor

Connecting the controller stop

1. Connect the + conductor to terminal 17 (wall-mounted enclosure) or terminal 2/1 (control panel enclosure).
2. Connect the – conductor to terminal 18 (wall-mounted enclosure) or terminal 2/2 (control panel enclosure).

Connecting the sample-water sensor

Cable colours and marking: See connections of measuring-cell types AQC-D1/AQC-D2/AQC-D3.

1. Connect the + conductor to terminal 19 (wall-mounted enclosure) or terminal 2/3 (control panel enclosure).
2. Connect the – conductor to terminal 20 (wall-mounted enclosure) or terminal 2/4 (control panel enclosure).

Note

When using measuring cell AQC-D2, the water sensor must always be connected and activated!

Connecting the Pt100 temperature sensor

1. Connect the + conductor to terminal 21 (wall-mounted enclosure) or terminal 1/11 (control panel enclosure).
2. Connect the – conductor to terminal 22 (wall-mounted enclosure) or terminal 1/12 (control panel enclosure).

12.6 Connection of measuring cells

Jumper setting

- All measuring values except for peroxide:
All cell types: position 1 (standard).
- Measuring value peroxide:
Cell type HP (peroxide): position 1 (standard).
- Measuring value peroxide:
Cell types AQC-D1/AQC-D3: position 2 (move the wire strap of the jumper (blue) to the higher position).

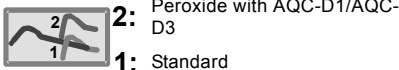


Fig. 11 Jumper setting

12.6.1 Connection of wall-mounted enclosure Conex® DIA-2

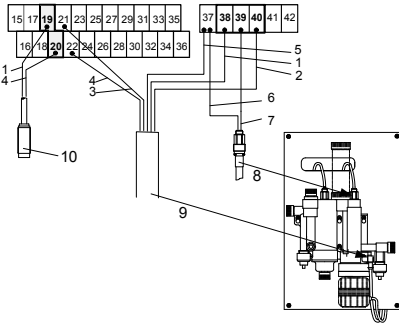


Fig. 12 Connection to measuring cells AQC-D1/AQC-D2/AQC-D3

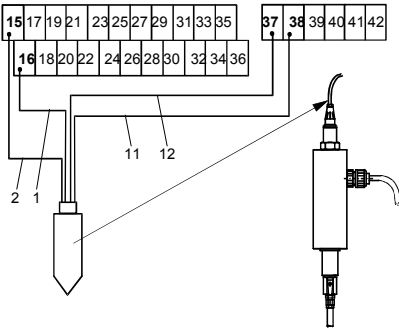


Fig. 13 Connection to measuring cells HP (peroxide)

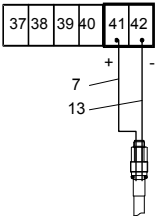


Fig. 14 Connection to single-rod measuring chains for pH, redox and fluoride

12.6.2 Connection of control panel enclosure Conex® DIA-2

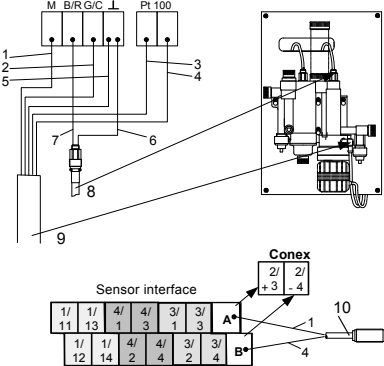


Fig. 15 Connection to measuring cells AQC-D1/AQC-D2/AQC-D3

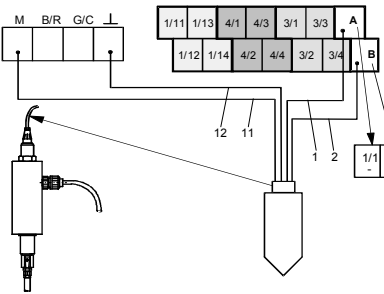


Fig. 16 Connection to measuring cells HP (peroxide)

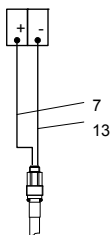


Fig. 17 Connection to single-rod measuring chains for pH, redox and fluoride

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Pos.	Description
1	Brown
2	White
3	Black
4	Blue
5	Screen
6	Outer conductor (screen)
7	Inner conductor
8	Reference electrode
9	Measuring electrode
	Counter electrode
	Pt100 temperature sensor
10	Water sensor
11	Yellow
12	Green
13	Outer conductor

Peculiarities for the connection at the control panel enclosure of Conex® DIA-2

1. First connect the measuring cells, the single-rod measuring chains and the water sensor (if present) to the separate sensor interface.
2. Secondly, connect the sensor interface to the **Conex® DIA-2** control panel enclosure.

Connecting the sensor interface to the Conex® DIA-2 (see back side of device)

- **Measuring cells AQC-D1/AQC-D2/AQC-D3/HP (peroxide)**
Connect terminals 4/1 to 4/14 of the sensor interface to the corresponding terminals of the **Conex® DIA-2**.
- **Measuring cells HP (peroxide)**
In addition, connect terminal A to terminal 1/1 and terminal B to terminal 1/2 of the **Conex® DIA-2**.
- **Single-rod measuring chains (pH)**
Connect terminals 3/1 to 3/4 of the sensor interface to the corresponding terminals of the **Conex® DIA-2**.
- **Sample-water deficiency sensor**
Connect terminal A to terminal 2/3 and terminal B to terminal 2/4 of the **Conex® DIA-2**.

Note *When using measuring cell AQC-D2, the water sensor must always be connected and activated!*

DIP switch

- If necessary, set the DIP switch for the desired measured value to "On" (move the switch to the right, top switch 1 is not used).

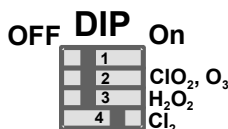


Fig. 18 DIP switch

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13. Operation

13.1 Control and display elements

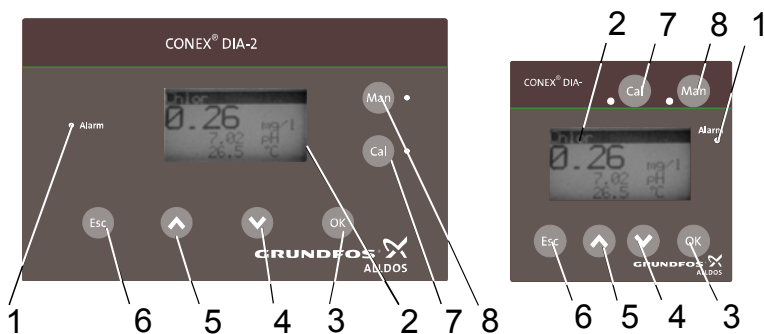


Fig. 19 Wall-mounted enclosure and control panel enclosure

Pos.	Description
Control elements	
1	Red alarm LED <ul style="list-style-type: none"> Flashes in case of faults or incorrect entries.
2	Display
Operating buttons	
3	[OK] button <ul style="list-style-type: none"> Enters the selected menu. Confirms the selected line or value.
4	[Down] button <ul style="list-style-type: none"> Moves one line downward (the selected line is displayed inversely). Decreases values.
5	[Up] button <ul style="list-style-type: none"> Moves one line upward (the selected line is displayed inversely). Increases values.
6	[Esc] button <ul style="list-style-type: none"> Returns to the previous menu. <ul style="list-style-type: none"> The data which were entered last are not changed.
Function buttons with yellow LED	
7	[Cal] button <ul style="list-style-type: none"> Switches between calibration and measuring mode. <ul style="list-style-type: none"> In calibration mode, the corresponding LED illuminates.
8	[Man] button <ul style="list-style-type: none"> Switches between automatic and manual modes. <ul style="list-style-type: none"> In manual mode, the corresponding LED illuminates.

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13.2 Display elements during initial commissioning

When connected to the power supply on the device's initial commissioning and following the start-up indication, the display shows the "Sprache/language" menu.

Language/Langue...
Deutsch
English
Français
Nederlands

- The word "language" in the header is displayed in all available languages successively at intervals of approximately one second.

Start the **Conex® DIA-2** by selecting the desired operating language:

- Select the desired language using the [Up] and [Down] buttons.
 - The selected language is displayed inversely (white letters on black background).
- Press [OK] to confirm.

The selected language is stored and will remain the operating language when the device is rebooted. If necessary, the operating language can be changed in the "language" submenu in the "setup" menu.

Note

See section 13.5 Setup.

The translations for the words "setup" and "language" into the currently available languages are:

Deutsch		
Hauptmenü	Grundeinstellung	Sprache
English		
main menu	setup	language
Français		
Menu principal	Paramétrage	Langue
Nederlands		
hoofdmenu	basisinstelling	taal
Español		
Menu principal	Ajuste básico	Idioma
Italiano		
Menu principale	programm. fond.	lingua
Português		
Menu principal	Posição inicial	Língua
Русский		
главное меню	станд. настройка	язык
Polski		
manu główne	ustawienia	język

chlorine
0.43 mg/l

- After selecting and confirming the operating language by pressing [OK] during initial commissioning, the display shows "chlorine" as the value to be measured.
 - On subsequent start-ups, the display will show the measured value selected the previous time.

chlorine
0.43 mg / l
5.20 pH c
22 °C c

- On upward or downward violation of the selected measuring range, the display will show the upper or lower limit and flash.

See sections 10.4 Measuring ranges and 13.5.4 Setting the measuring ranges for chlorine, chlorine dioxide, ozone, peroxide and pH.

13.2.1 Display modes

Switching between display modes 1 and 2:

- Use the [Up] and [Down] buttons to switch between the two display modes:

Display mode 1 with two parameters

ClO ₂	pH
0.30	mg/l
4.00	pH

The large display shows the measured values for the two parameters (for example ClO₂ and pH). The inverted font in the header displays the two parameters left-justified and right-justified.

The measured value for the left-justified parameter 1 is displayed in the first line, and the measured value for the right-justified parameter 2 is displayed in the second line underneath the header. The measured value for a possibly active temperature measurement is not output in this display mode.

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Display mode 2 with two parameters

ClO ₂	pH
0.30	mg/l
4.00	pH c
100.0	°C c

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The large display shows the measured values for parameter 1, and the small display shows the measured values for parameter 2 and the possibly active temperature measurement. "c" is displayed if the compensation functions are active.

Display with one parameter

ClO ₂
0.30
mg/l
100.0
°C c

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The large display shows the measured values, and the selected parameter is displayed in the header. The measured value for a possibly active temperature measurement is shown in the second line. "c" is displayed if the compensation functions are active.

Alarm signals

A parameter-based alarm refers to the flashing parameter in the header. Parameter-independent alarms are displayed in the bottom line, but the display does not flash for this alarm.

If several alarms are present, they can be scrolled using the [Up] and [Down] buttons. They are displayed in chronological order. The selected alarm signal is displayed with inverted font. Subsequently, the display is switched to the last display mode set.

Display mode with active alarms and two parameters

ClO ₂	pH
0.30	4.00
alarm line 1	
alarm line 2	

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The parameters are displayed left-justified and right-justified in the header, and the measured values of the parameters are displayed directly underneath. The measured value for a possibly active temperature measurement and the display "c", if the compensation functions are active, are suppressed.

Display mode with active alarms and one parameter

ClO ₂
0.30
mg/l
alarm line 1
alarm line 2

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The large display shows the measured values, and the selected parameter is displayed in the header. The measured value for a possibly active temperature measurement and the display "c", if the compensation functions are active, are suppressed.

13.3 Software overview

Provided that the code numbers for access right have been set, some menus (and submenus) as well as the functions Cal and Man are protected against unauthorised access. The protected menus are marked with "C" (calibration rights) or "F" (full rights).

Note

Main menus

- Controller 1 / 2, see section [Controller 1/2](#).
- Alarm 1 / 2, see section [Alarm 1/2](#).
- Service, see section [Service](#).
- Setup, see section [Setup](#).

Function buttons

- Cal, see section [Calibration function](#).
- Man, see section [Manual operation](#).

Controller 1/2

"F" (full rights)

Setting the parameters

- Relay 1/2
 - setpoint
 - controller parameters.
- Continuous controller
 - setpoint
 - controller parameters.

Alarm 1/2

"F" (full rights)

- Alarm settings
 - alarm 1/2 values (switching points)
 - effective direction
 - hysteresis
 - alarm delay.
- Dosing time monitoring
 - maximum dosing time (at constant dosing flow level of 100 %).

Service

- Calibration logbook 1/2
 - the last 10 calibrations.
- Calling up the controller 1/2 settings
- Test of functioning of current outputs
- Test of functioning of relays
- Test of functioning of display.

Setup

"F" (full rights)

- Selecting language
- Parameter 1/2: selecting measured values
- Selecting measuring cell
- Selecting measuring range
- Configuration of controller 1/2
- Switching on/off water sensor
- Time setting
- Code function
- Display contrast
- Calling up factory settings
- Current output: assignment of current outputs to measuring ranges
- Calling up program version.

Calibration function

"C" (calibration rights)

- Calibration of selected parameters
 - chlorine, chlorine dioxide, ozone, peroxide, pH.

Manual operation

"C" (calibration rights)

- Running the configured controllers manually.

13.4 Main menu

1. Switch to "main menu" by pressing [OK] or, if necessary, by pressing [Esc] several times.

Options in "main menu"

main menu
controller
alarm
service
setup

- **"controller"**
In this submenu, a controller can be parameterised. This option will only be displayed if a type of controller has been selected in the "setup" menu.
- **"alarm"**
In this submenu, the measured value is compared with the permitted value, and an alarm is triggered, if necessary.
- **"service"**
Diagnosis submenu. The measured values and the last 10 alterations of calibration data can be viewed. In this mode, values cannot be altered. If measuring cell AQC-D2 is selected, the data of the water sensor can be viewed.
- **"setup"**
In this submenu, the settings for language, parameters, measuring ranges, controllers, etc. can be adjusted.

Selecting the functions "calibration" and "manual operation"

See the buttons [Cal] and [Man] to the right of the display.

- **Calibration:** Press [Cal] to switch to the calibration menu (the yellow LED illuminates).
- **Manual operation:** Press [Man] to switch to manual operation (the yellow LED illuminates).

Switching to manual operation is only possible if a controller type has been selected in the "setup" menu. The functions "Cal" and "Man" can only be accessed by persons with calibration rights or full rights.

Note

13.5 Setup

All standard settings of the device can be defined in the "setup" menu. During initial commissioning, basic functions are configured which after that should only be altered rarely or even not at all.

The "setup" menu can only be accessed by persons having full rights.

See section [13.5.8 Code function](#).

Enter the code number.

13.5.1 Selection of measured values for chlorine, chlorine dioxide, ozone, peroxide and pH

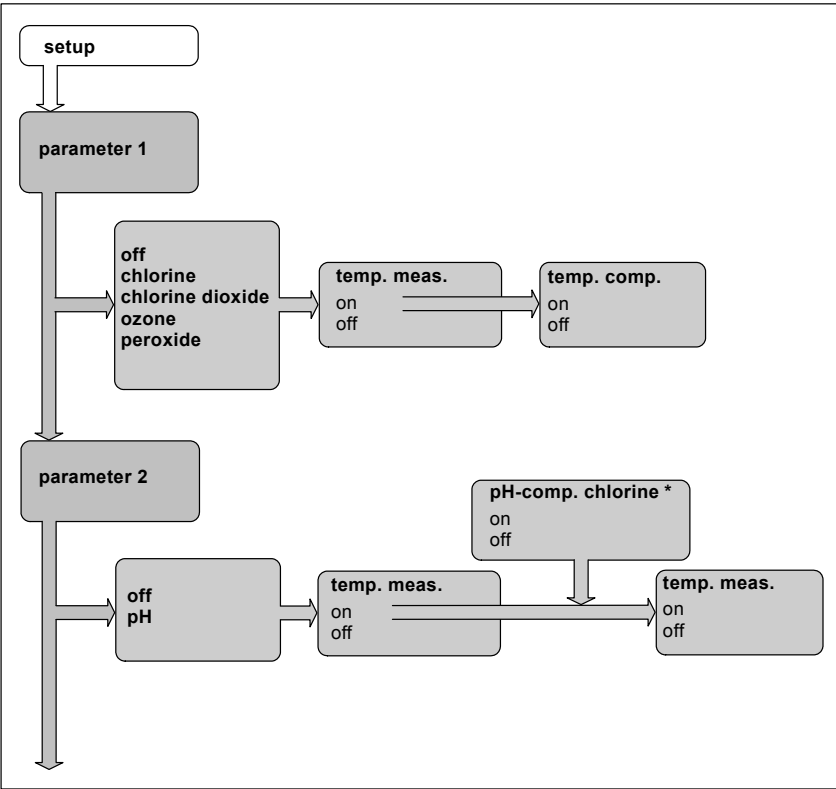


Fig. 20 Selection of measured value in menus "parameter 1" and "parameter 2"

* pH-comp. chlorine is only available if chlorine and pH have been selected as parameters.

1. Select the line "parameter 1" / "parameter 2" using the [Up] and [Down] buttons, and press [OK] to switch to the corresponding menu.
2. Use the [Up] and [Down] buttons to select the measured variable (parameter). Press [OK] to confirm.
3. Use the [Up] and [Down] buttons to select further settings. Press [OK] to confirm.

13.5.2 pH and temperature compensation

pH compensation with chlorine measurement

The dissociation of hypochlorous acid (HOCl) into the hypochlorit-anion (OCl⁻) leads to a loss of slope (loss of sensitivity) of the sensor for chlorine measuring.

Using a mathematical compensation function, this loss of sensitivity can be eliminated.

Temperature compensation

Using a compensation function, the influence of temperature on the measurement can be eliminated mathematically.

Control field for pH value, pH compensation, temperature and temperature compensation in the display of measured value

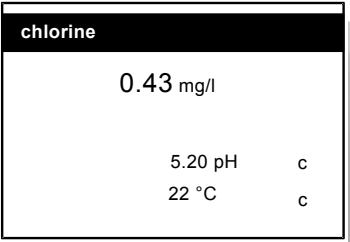


Fig. 21 Chlorine measurement with pH and temperature compensation

- Press [Esc] once or twice to change to the display with the measured value.

See sections [13.2 Display elements during initial commissioning](#) and [13.6.3 Controller control fields on the display](#).

In addition to the current measured value, the current pH value and the temperature of the sample water are indicated as well.

With activated pH compensation or temperature compensation, the letter "c" for "compensation" is displayed at the end of the line.

With deactivated temperature measurement, the water temperature for compensation should be entered manually after calibration. See section [13.9.2 Calibrating the pH value](#).

13.5.3 Selection of measuring cell

Note

The "measuring cell" submenu is shown only if the measured values chlorine, chlorine dioxide, ozone or peroxide were selected during the parameterisation.

Names of the measuring cells contained in the software

- AQC-D1
- AQC-D2
- AQC-D3
- HP (peroxide).

The measuring cell that corresponds to the selected measured value can be selected:

- AQC-D1/AQC-D2/AQC-D3 with chlorine, chlorine dioxide or ozone
- AQC-D1/AQC-D3, HP with peroxide.

Monitoring the cleaning motor (measuring cells AQC-D1)

Having selected measuring cell type AQC-D1, press [OK] to get to the "cleaning motor" submenu.

1. Switch the monitoring of the cleaning motor on/off.

Measuring cell AQC-D2 / -D3 selected



Fig. 22 Chlorine measurement with AQC-D2 / -D3

A black bar on the display indicates the actual data of the water sensor.

See installation and operating instructions for the potentiostatic measuring cell AQC-D2 / -D3.

13.5.4 Setting the measuring ranges for chlorine, chlorine dioxide, ozone, peroxide and pH

In the "measuring ranges" menu, the corresponding measuring ranges are assigned to the measured values which have been selected in the "parameters" menu.

- In the "measuring ranges" menu, the following options are available:
 - standard measuring ranges
 - "others".

See section [10.4 Measuring ranges](#).

- The measuring ranges for temperature can be defined in °C (Celsius) or in °F (Fahrenheit).

The "temperature" submenu is only shown if the temperature measurement has been switched on in the "parameter" menu, or if parameter pH has been selected.

Note

13.5.5 Controller parameters 1/2

See section [13.6 Selection, configuration and parameterisation of the controller](#).

13.5.6 Water sensor

In the "wat. def. sensor" menu, the water sensor can be switched on/off.

In the event of sample-water deficiency, the following will occur:

- The malfunction-indicating relay is activated, and the alarm message "fault water sensor" is triggered.
- With devices with control functions, the actuators are switched to passive or closed.

Caution

The water sensor must be switched on for the measuring cell AQC-D2!

13.5.7 Setting the current time (date/time/summer time)

1. Switch from the "setup" menu to the "date/time" menu.

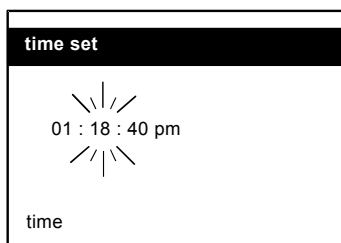


Fig. 23 Time setting

2. Set the device to the current time in the "time set" menu in the format hh.mm.ss.
 - Press [OK] to switch to the next number field. The number field which is currently activated flashes.
 - Alter the settings by pressing the [Up] and [Down] buttons.
 - Pressing the buttons continuously makes the adjustment dynamically faster.
3. Set the device to the current date in the "date" menu in the format mm.dd.yyyy with English as operating language or the format dd.mm.yyyy for all other languages similarly to the adjustment of time. The corresponding day of the week (Mo...Su) is displayed automatically.
4. If necessary, enter the beginning and end date of the summer time, the kind of time shift and the number of hours of the time shift.

13.5.8 Code function

The code function is designed to protect the device from unauthorised access.

Entering the four-digit code number and changing it

1. Select the line "code function" in the "setup" menu using the [Up] and [Down] buttons, and press [OK] to switch to the corresponding menu.

There are two types of access rights:

Calibration rights: The owner of calibration rights has access to the calibration menu and to manual operation.

The owner of access rights may do the following:

- alter calibration data
- operate control relays manually.

Full rights: The owner of full rights has full access to all settings including calibration data.

The owner of full rights may do the following:

- alter calibration data
- alter setup
- parameterise the controller
- alter alarm settings
- run the device manually.

cal right	
code	0000
old code	

2. Select the desired type of access rights, and press [OK] to get to the corresponding menu.
 3. If an old code exists, confirm the old code number first (on first use, confirm code 0000).
 4. Select "change".
 5. Enter the old code in the submenu (see the comment line at the bottom of the display) using the [Up] and [Down] buttons, and press [OK] to confirm and switch to the query "new code" (see the comment line at the bottom of the display).
 6. Enter a new four-digit code number using the [Up] and [Down] buttons. Press [OK] to confirm.
 7. Repeat to confirm: Set a new four-digit code number using the [Up] and [Down] buttons, and press [OK] to confirm.
 8. Access rights can be cancelled by deleting the corresponding code number in the "delete" submenu.
- Entering a valid four-digit code number gives the operator access to the corresponding functions for a limited time of 60 minutes.
 - If no code was entered previously, the desired menu can be accessed without restrictions. The code number 0000 will not be displayed / the operator will not be asked to enter it.

If a wrong code is entered, access to the corresponding menus is denied. An error message is triggered (duration: five seconds), and the device will return to "main menu".

Note

13.5.9 Reset function

- Entering the code number "1998" deletes all previously entered code numbers.
- All prior access codes are deleted and reset to "0000".

13.5.10 Adjusting display contrast

In the "display" menu, the contrast of the display can be adjusted.

1. Switch from the "setup" menu to the "display" menu using the [Up] and [Down] buttons, and press [OK] to confirm.

If the contrast setting is too high, it may not be possible to read the display. Hold down the [Down] button until the contrast setting is low enough to be read again.

Note

13.5.11 Saving / accessing user settings

In the "factory setting" submenu, the current device setting can be saved so that it can be reactivated later, or a saved setting can be activated.

- Setup
 - Save setup: Saves all current device settings from the menus (not just the "setup" settings).
 - Activate setup: Resets the device to the last saved setup.

In this menu, save your device settings once you have set all the values in the "setup", "controller" and "alarm" menus. You can then activate them again at any time (even after a factory reset)!

Note

13.5.12 Factory setting reset

In the "factory setting" submenu, the **Conex® DIA-2** can also be reset to the factory setting using code 6742.

*Only use this function in an emergency.
All device settings are lost and must be re-entered!*

Caution

Do not disconnect the device from the power supply during the reset!

Resetting the **Conex® DIA-2** to the factory setting

- Reset
 - Code: 0000 is displayed.
 - Set code 6742 using the [Up] and [Down] buttons, and press [OK] to confirm.

The device is now returned to the original factory setting.

Before subsequent start-up:

Caution

Check all parameters and set the device again according to your application!

General factory settings

- Language**: The **Conex® DIA-2** is waiting for language input. The languages "Deutsch/English Français...." are indicated alternately.
- Summer time: off.
- Code numbers: 0000 calibration rights, 0000 full rights.
- Current outputs 1-4: 0-20 mA.
- Dosing monitoring: off.
- Parameter 1: chlorine.
- Parameter 2: off.

** For the first calibration, the default value = last setting.

Default values for parameter group 1

	Cl ₂	ClO ₂ /O ₃	H ₂ O ₂
Measuring range [mg/l]	0.00 - 2.00	0.00 - 1.00	0-100
Measuring cell	AQC-D1	AQC-D1	AQC-D1
Temperature measurement	off	off	off
Water sensor	off	off	off

Default values for parameter group 2

	pH
Measuring range	0.00 - 14.00
Temperature measurement	off
Water sensor	off

13.5.13 Current outputs

In the "current output" menu, the operator can assign the selected values to the current outputs and then assign the current outputs to the selected measuring ranges.

In the "current output" menu, the selected parameters are listed in the following order:

current output
chlorine
pH
temperature

- Output 1: parameter group 1: chlorine, chlorine dioxide, ozone, hydrogen and peroxide
- Output 2: parameter group 2: pH
- Output 3: temperature or continuous controller for parameters from group 2
- Output 4: continuous controller for parameters from group 1.

Assignment of the current outputs to the measuring range (example: chlorine measurement)

There are two standard ranges, "0-20 mA" and "4-20 mA" which can be assigned to the current outputs. They are assigned to the measuring range linearly.

The start-of-scale and full-scale values can be freely defined within 0 to 20 mA in an optional setting for the current outputs 1 and 2 as well as for current output 3 with temperature measurements.

chlorine
0-20 mA
4-20 mA
others

- In the corresponding submenu (for example chlorine), select the line "others" using the [Up] and [Down] buttons. Press [OK] to confirm.
- In the subsequent display "0.00 mg/l", enter the start-of-scale value of the range using the [Up] button. Press [OK] to confirm.
 - In the same line, "= 0 mA" is displayed.

chlorine
0.20 mg/l = 0 mA

- Enter the associated start-of-scale current value using the [Up] button. Press [OK] to confirm.
 - An additional line is displayed with the scan for the full-scale value of the range "20.00 mg/l".
- Enter the full-scale value of the range using the [Down] button. Press [OK] to confirm.
 - In the same line, "= 20 mA" is displayed.

chlorine
0.20 mg/l = 0 mA
15.00 mg/l = 20 mA

- Enter the associated full-scale current value using the [Down] button. Press [OK] to confirm and return to the "current output" menu.

13.5.14 Program version

program version
Conex DIA-2
v0.20.1 20030304

In case problems make it necessary to contact our service department, the "program version" menu enables the operator to easily identify the software components of the actual device.

- Version, for example **v0.20.1**.
- Last update: **yyymmdd**.

13.6 Selection, configuration and parameterisation of the controller

It takes two steps to set up the controller:

- First: selection and configuration of the controller type in the "setup" menu, "controller" submenu.
- Secondly: parameterisation of the selected controller type in "main menu", "controller" submenu.

13.6.1 Selection and configuration of the controller

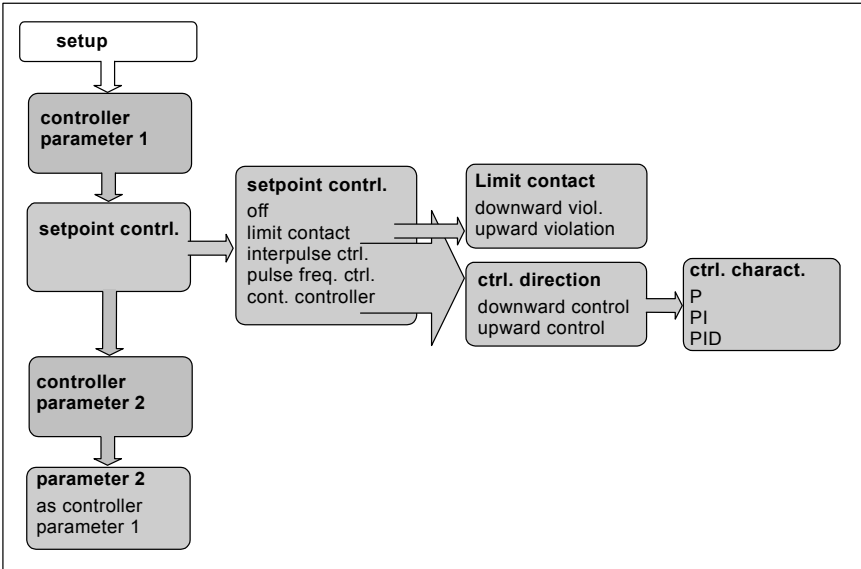


Fig. 24 Selection and configuration of the controller

- In the "setup" menu, select the line "controller parameter 1" or "controller parameter 2" using the [Up] and [Down] buttons, and select the menu with the same name using [OK].

Selection and configuration of the setpoint controller

1. Mark the "setpoint ctrl" line using the [Up] and [Down] buttons, and select using [OK].

2. Select the controller using the [Up] and [Down] buttons as one of the following:

- off
- limit contact
- interpulse controller (two-position controller)
- pulse frequency controller (two-position controller)
- continuous controller

and confirm using [OK].

If "limit contact" is selected:

3. Use the [Up] and [Down] buttons to select the switching direction as one of the following:

- downward violation
- upward violation

and confirm using [OK].

If "interpulse ctrl.", "pulse freq. ctrl" or "cont. controller" is selected:

4. Use the [Up] and [Down] buttons to select the control direction as one of the following:
 - downward control (switches with upward violation of setpoint)
 - upward control (switches with downward violation of setpoint)
 and confirm using [OK].
5. Use the [Up] and [Down] buttons to select the control response as one of the following:
 - P (proportional controller)
 - PI (proportional-plus-integral controller)
 - PID (proportional-plus-integral-plus-derivative controller)
 and confirm using [OK].

13.6.2 Setting the controller parameters

1. Select a controller in the "setup" menu and configure it.
- See section [13.5.5 Controller parameters 1/2](#).
2. Select the line "controller" in "main menu" using the [Up] and [Down] buttons, and press [OK] to switch to the "controller" menu.
- See section [13.4 Main menu](#).

Note *The "controller" option in "main menu" is only available if a controller has been selected in the "setup" menu!*

The options available in the "controller" submenu (main menu) correspond to the configuration made in the "setup" menu.

1. Use the [Up] and [Down] buttons to change internal setpoints within the selected measuring range.
- See section [10.4 Measuring ranges](#).
2. Select the displayed controller parameters using the [Up] and [Down] buttons, press [OK] to switch to the desired submenu, and use the [Up] and [Down] buttons to adjust the setpoints as needed within the permitted ranges.

See section [10.3 Electronic data and functions](#).

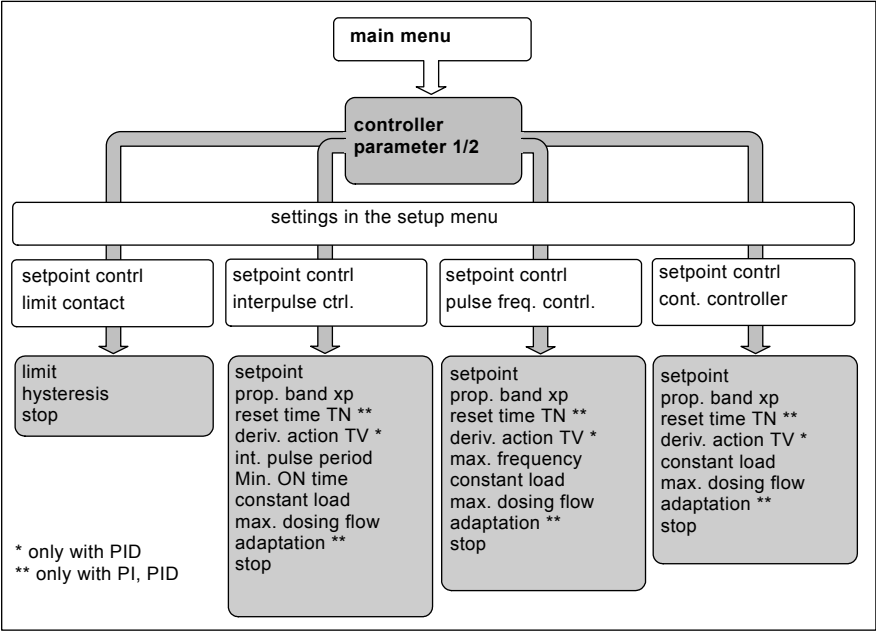


Fig. 25 Settings for setpoint controllers

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13.6.3 Controller control fields on the display

1. Press [Esc] once or twice to switch to the display "measured value".

See sections [13.2 Display elements during initial commissioning](#) and [13.2.1 Display modes](#).

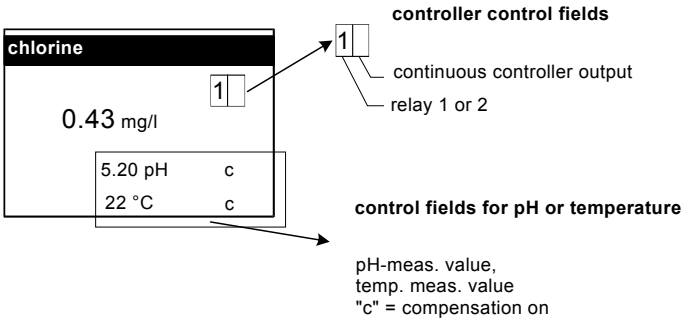


Fig. 26 Chlorine measurement with pH and temperature compensation

- The control fields for relays 1 and 2 appear as follows for configured limit monitors / two-position controllers:
Unfilled field for relay off:

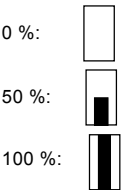


Filled field (displayed inversely) for relay on:



- The control field for the continuous controller is empty, partially filled or completely filled depending on the set dosing rate - and when configured accordingly - and the filling of the bar always refers to 100 % of dosing rate.

Example:

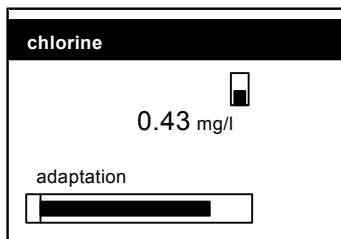


13.6.4 Adaptation

An adaptation can be started to simplify the setting of the controller parameters.

The adaptation is only available for PI and PID controllers.

1. Start adaptation in the "controller" menu (main menu) under "adaptation" by pressing "start".



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Fig. 27 Chlorine measurement with adaptation of continuous controller

2. Return to the display "measured value" automatically. A black bar on the display indicates the adaptation process. The LED next to the [Man] button flashes during the whole adaptation. A progress bar shows the advancement of the adaptation.
- The configured controllers can only be adapted separately.
- On upward control, the measuring value has to be more than 20 % below the setpoint.
- On downward control, the measuring value has to be more than 20 % above the setpoint.

In case of a fault, the message "Start conditions false" is shown directly after the start.

3. The message "adaptation successful" is shown after ending the adaptation.
4. Press [OK] or [Esc] to quit. The determined controller settings are automatically adapted by the parameterisation of the controller. They are displayed in the adaptation menu under "adapt. result".
5. If the adaptation was not successful, the message "adaption abortive" is shown. Press [OK] or [Esc] to quit.

The adaptation may be aborted in the following cases:

- If an error message was shown during the adaptation.
- If the controller is set to manual operation.
- If the standstill time was more than one hour.
- If the total measuring time was more than two hours.

Note

With selected temperature/pH measurement, the temperature value, pH value and their compensations will not be displayed during the adaptation.

13.7 "Alarm" menu

With the help of the alarm function, the measured value can be monitored and compared with the permitted range.

If the measured value exceeds the limits of the measuring range, an alarm is triggered.

- The alarm relay is activated after the selected alarm delay time.
- When the cause of the alarm has been removed, the relay is deactivated immediately (without delay).

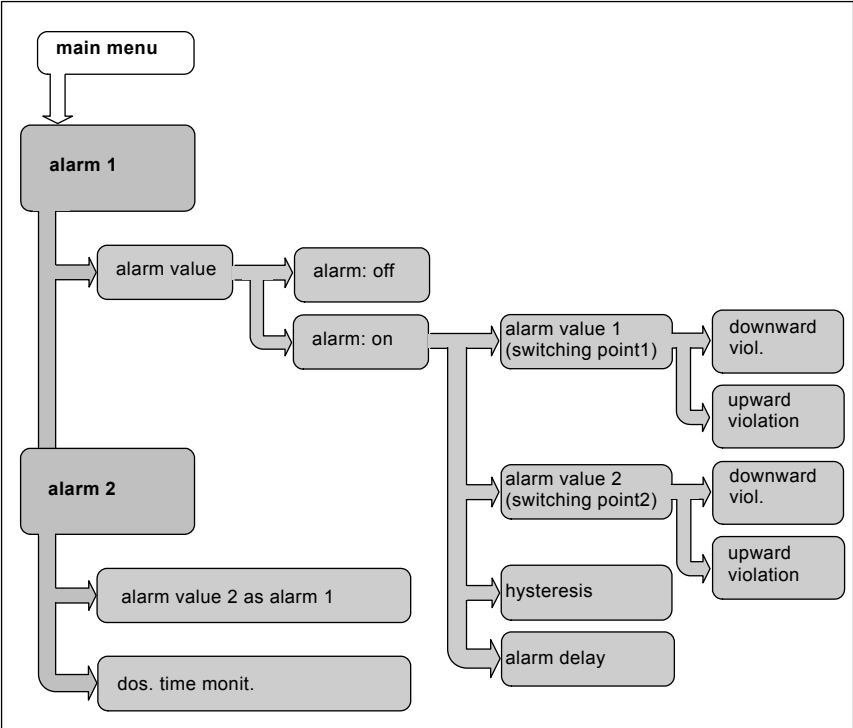


Fig. 28 "Alarm" menu in "main menu"

1. Select the line "alarm" in "main menu" using the [Up] and [Down] buttons.
 2. Press [OK] to switch to the "alarm" menu.
- Two functions are available there:

alarm
alarm values
dos. time monit.

- **alarm values:** If the measured value exceeds the permitted range, the alarm relay is activated and an alarm message is triggered. The red alarm LED starts flashing.
- **dos. time monit.:** If the dosing flow constantly remains at 100 % during a selected maximum dosing time, the alarm relay is activated and an alarm message is triggered. The red alarm LED starts flashing.

Setting the alarm values

1. Select the line "alarm values" using the [Up] and [Down] buttons. Press [OK] to switch to the "alarm on/alarm off" submenu.
2. Confirm the line "alarm on" using [OK], and select the "alarm values" selection menu.

Setting the upper and lower switching point (limits)

1. Select the line "alarm value 1" or "alarm value 2". Press [OK] to confirm and switch to the desired menu.

alarm value 1
0.00 mg/l
switching point1

2. Set switching points between 0 and the upper limit of the measuring range defined earlier using the [Up] and [Down] buttons (in the unit of the measured value, the resolution depends on the selected measuring value and measuring range).

See section [10.4 Measuring ranges](#).

3. Press [OK] to switch to the "eff. direction" menu. Options: alarm message in the event of upward/downward violation of the selected switching point.
4. Select the desired line using the [Up] and [Down] buttons.
5. Press [OK] to return to the "alarm values" menu automatically.
6. Select the line "hysteresis" in the "alarm values" menu, and press [OK] to switch to the corresponding submenu.

alarm values
0.00 mg/l
hysteresis

7. Set the hysteresis to a value between 0 and half of the measuring range using the [Up] and [Down] buttons.

The hysteresis ensures that the relays switch less frequently in the event of upward or downward violation of the limits.

8. Press [OK] to return to the "alarm values" menu.
9. Select the line "alarm delay" in the "alarm values" menu, and press [OK] in the corresponding submenu.

alarm values
0 sec
alarm delay

10. Set the alarm delay to a value between 0 and 300 seconds using the [Up] and [Down] buttons.

13.7.1 Dosing time monitoring

This function can be used to monitor the dosing process. If the dosing flow remains at a constant level of 100 % during a selected period, an alarm message is triggered.

dos. time monit.
10 min
max. dosing time

1. Select the line "dos. time monit." in the "alarm" menu, and press [OK] to switch to the corresponding submenu.

In the "dos. time monit." menu, the monitoring function can be switched on or off.

- If "off" has been selected, the device returns to the "alarm" menu.
 - If "on" has been selected, the "dos. time monit." submenu is displayed.
2. Set the maximum dosing time to a value between 0 and 600 minutes using the [Up] and [Down] buttons.

13.8 Checking the settings in the "service" menu

In the "service" menu, the operator can check all important settings and test the functions of the device in the event of problems that make service necessary.

Note In the "service" menu, calibration data and controller settings cannot be altered. Therefore the menu can be accessed without an access code.

Select the line "service" in "main menu", and press [OK] to switch to the corresponding menu.

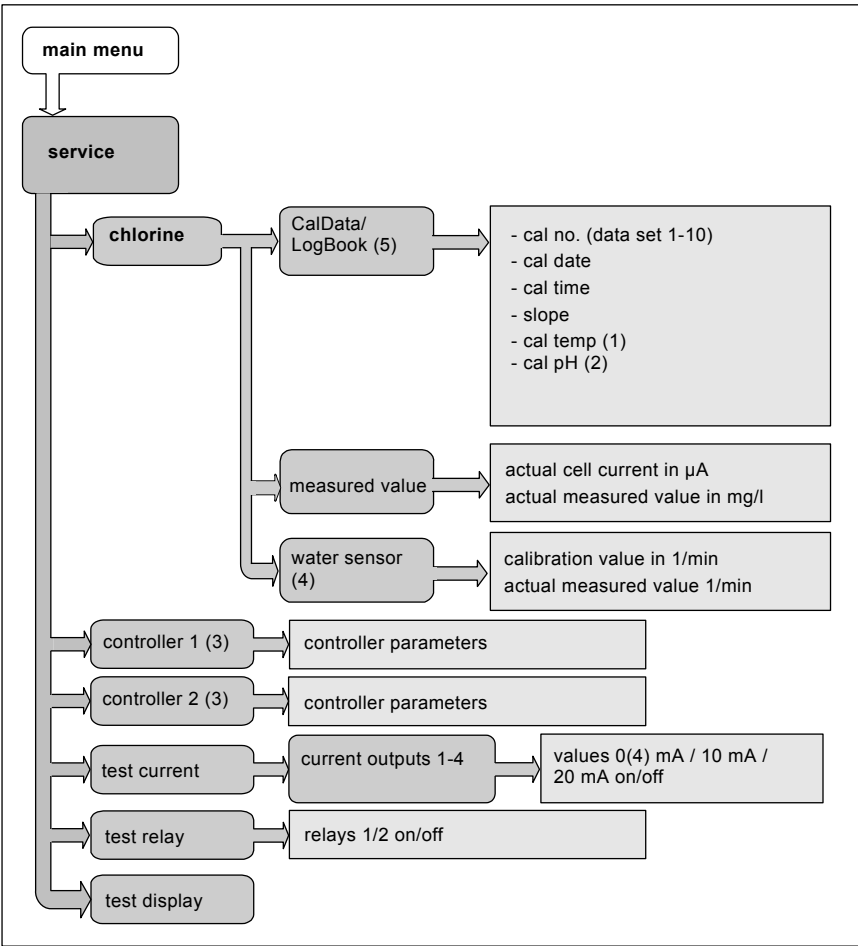


Fig. 29 Example: chlorine measurement

Notes to figures in fig. 29:

(1)	"cal temp." will only be displayed if temperature measurement or temperature compensation has been switched on in the "setup" menu.
(2)	"cal pH" will only be displayed if pH measurement or pH compensation has been switched on in the "setup" menu.
(3)	"controller" will only be displayed if a controller has been selected and configured in the "setup" menu and in the "main menu".
(4)	"water sensor" will only be displayed if measuring cell AQC-D2 has been selected in the "setup" menu.
(5)	"CalData/LogBook" will only be displayed if a calibration has already been made.

service
chlorine
test current
test relay

In the "service" menu, the following items are listed:

- "parameter": displaying data of the previous 10 calibrations
- "controller": checking controller settings
- "test current": testing the functioning of the current outputs
- "test relay": testing the functioning of the relays
- "test display": testing the functioning of the display.

"parameter": logbook registration of calibration data

The calibration data of all activated measuring values are registered in chronological order by a logbook function.

Example: With pH measurement, the logbook lists the following data:

- calibration number with date/time
- slope (sensitivity of the electrode)
- asymmetric potential of the electrode
- temperature of the buffer solution used.

Under "measured value", the following data are displayed:

- current measured value
- current cell voltage or cell current.

Under "water sensor", the following data are displayed:

- speed of water sensor during last calibration
- actual speed of the water sensor.

"controller" (checking controller settings)

1. Select the [Up] or [Down] button depending on the controller, and select the corresponding menu using [OK].
 - In the first line, the configured type of controller is displayed, and in the subsequent lines the current controller settings are listed. (Select the value y_{out} using [OK]).

"test current" (testing the functioning of the current outputs)

1. Select the current output to be tested using the [Up] and [Down] buttons, and press [OK] to switch to the corresponding menu.

Depending on the configuration of the current outputs, the current outputs can be switched on with the following current values, and the current value can be output to the system:

- test currents of 0, 10, 20 mA with selected standard range 0-20 mA
- test currents of 4, 12, 20 mA with selected standard range 4-20 mA or with freely adjusted current outputs.

2. Select the current values using the [Up] and [Down] buttons.

- When a line is selected, the state of the current output with the corresponding value is automatically set to "on".
- As soon as another line is selected, the previous current value is automatically switched off, and the new current value is set to on.

"test relay" (testing the functioning of the relays)

1. Select the relay to be tested using the [Up] and [Down] buttons, and press [OK] to switch it on or off.

If either of the lines "relay 1", "relay 2" or "alarm" has been selected, the relay that was the last one activated before entering the test menu is switched off. Considering the current alarm values and controller values, the relay is switched on again when the test menu is left.

"test display" (testing the functioning of the display)

- If the display turns completely dark: The display functions OK.
- If the display stays partly bright: The display is faulty.
- Press [OK] to leave the test menu.

13.9 Calibration

1. Press [Cal] to switch to the calibration menu.
 - The LED next to [Cal] illuminates.
 2. Depending on the set access rights, it may be necessary to enter the four-digit code number using the [Up] and [Down] buttons. Confirm using [OK].
 3. Select a parameter for the calibration.
- In order to avoid an overdosing, the controllers are switched off, and the final control elements are closed.

13.9.2 Calibrating the pH value

13.9.1 Peculiarities for the calibration of chlorine with pH compensation

Caution

pH calibration is of prime importance, since during the calibration of the chlorine value, the device uses the already calibrated measured value for pH as a reference value.

Therefore the pH value must be calibrated first!

Only then calibrate the chlorine value!

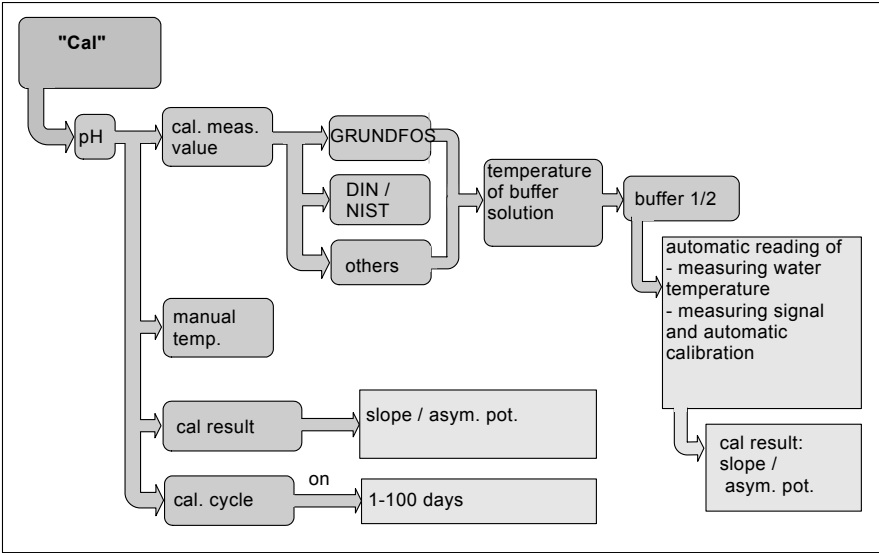


Fig. 30 Calibrating the pH value

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The pH calibration is carried out as a two-point calibration.

pH
cal. meas. value
cal result
cal. cycle

1. Press [Cal] to switch to the calibration function. Select the line "pH", and press [OK] to switch to the "pH" calibration menu.
2. Select "cal. meas. value", and press [OK] to switch to the corresponding menu.

Selecting buffer types and buffer values, reading in buffer values and calibrating

Three optional buffer types are available:

- GRUNDFOS: buffer values pH 4.01, 7.00, 9.18.
- DIN/NIST: buffer values pH 4.01, 6.86, 9.18.
- "others": Lower and upper buffer values can be freely adjusted (difference at least 1 pH) within the configured pH value measuring range ("setup" menu).

buffer
GRUNDFOS
DIN/NIST
others

1. Select a buffer type using the [Up] and [Down] buttons.
2. Press [OK] to jump to the "temperature" menu automatically.
3. Enter the temperature of the buffer solution used.
4. Press [OK] to jump to the "buffer value 1" menu automatically.

buffer value 1
4.01 pH
7.00 pH
9.18 pH

5. Select one of the three optional buffer values offered for the buffer solutions GRUNDFOS or DIN/NIST.
6. Fill buffer 1 from the storage bottle into a clean calibration cup.
7. Dip the electrode into the buffer solution.

8. Press [OK] to start the automatic reading function (reading in of measured signal) and the calibration.
 - The display shows the message "please wait" during the calibration.
 - The automatic reading function during pH calibration has the effect that the correct electrode signal for the buffer value is read in only when the measuring signal remains stable during a defined interval.
9. Dispose of the first buffer solution (i.e. do not return it to the storage bottle!), and rinse the electrode with water.
10. Press [OK] to jump to the "buffer value 2" menu automatically.

buffer value 2
7.00 pH
9.18 pH

It is only possible to choose between the two remaining buffer values.

1. Fill buffer solution 2 from the respective storage bottle into a clean calibration cup.
2. Dip the electrode into the second buffer solution.
3. Press [OK] to start the automatic reading function and the calibration.
4. After that, dispose of the buffer solution and rinse the electrode with water.

CALDATA pH
slope
- 60.17 mV / pH
asym. pot.
19 mV

Immediately after the calibration, its result is displayed automatically:

- sensor slope in mV/pH
- asymmetry potential of the electrode in mV.

Error messages during the reading in of the voltage signal of the pH electrode

The calibration may be aborted in the following cases:

- If the electrode is faulty or a wrong buffer has been used.
 - The message "fault of electrode/buffer" is displayed.
- If the electrode does not reach a stable measuring signal in 120 seconds.
 - The message "calibration time exceeded" is displayed.
- If the result of the plausibility testing of the pH calibration data is upward/downward violation of the slope range of –50 to –62 mV/pH.
 - The message "slope error" is displayed.
- Downward/upward violation of the precision/ exactness range from –60 to +60 mV.
 - The message "error asym. pot." is indicated.

The calibration process will be aborted in all four cases.

- Press [OK] to return to the "calibration" menu automatically.

If the process is aborted, the old calibration date will not be overwritten!

Manual temperature compensation

With deactivated temperature measurement, the water temperature for compensation should be entered manually after calibration. The default value is 25 °C.

1. Determine the water temperature with a thermometer.
2. Press [Cal] to switch to the calibration function. Select the line "pH", and press [OK] to switch to the "pH" calibration menu.
3. Select "manual temp.", and press [OK] to switch to the corresponding menu.

manual temp.
25 °C

4. Enter the water temperature.
 - The water temperature is shown in °C (Celsius) or in °F (Fahrenheit), as selected in the "setup" menu "measuring ranges".
5. Press [OK] to return to the "calibration" menu automatically.

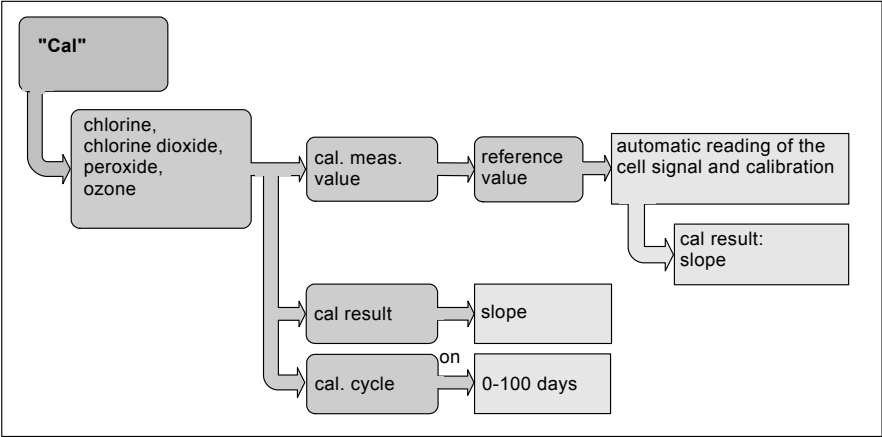
Cal. cycle

- Following selection of "cal. cycle" in the "measured value" menu, a countdown function is started which triggers the alarm signal "calibrate sensor" following expiry of a defined time interval of 1-100 days.

Cal result

- The result of the current (last) calibration can be displayed at any time using the "cal result" menu item.

13.9.3 Calibration of the parameters chlorine, chlorine dioxide, peroxide and ozone



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Fig. 31 Calibration of the parameters chlorine, chlorine dioxide, peroxide and ozone

Having switched to the calibration function by pressing [Cal], the display is in the mode "measured value" and indicates the current measured value.

1. Press [OK] to switch to the calibration menu (the first line reads "chlorine", for instance).

chlorine
cal. meas. value
cal result
cal. cycle

2. Select the line "cal. meas. value", and press [OK] to switch to the corresponding menu.

- In the bottom line, the entry field (value in mg/l) for the reference value (determined photometrically or analytically) and the present cell current or electrode current (in μA) are displayed.

cal. meas. value
0.45 mg/l
I-cell 10.4 μA

3. Enter a reference value (for example determined photometrically with the Grundfos Alldos DIT photometer).

4. Press [OK] to start calibration.

- An automatic reading function reads in the sensor data, and the calibration is carried out.
- The slope (sensitivity) of the sensor is calculated.
- Immediately after calibration, the result of the calibration is indicated automatically (first line: "cal. meas. value"):
 - The slope of the sensor in $\mu\text{A/ppm}$ is displayed.

CALDATA chlorine
slope
34.67 $\mu\text{A} / \text{ppm}$

13.10 Manual operation

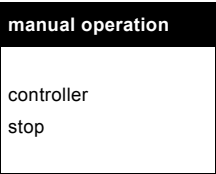
The manual operation mode is used to switch off the automatic control and run the control relays manually.

Note

Manual operation is only possible after a controller has been configured.

Manual operation can only be accessed with calibration rights or full rights.

1. Press [Man].



2. Depending on the set access rights, it may be necessary to enter the four-digit code number using the [Up] and [Down] buttons.
- The LED next to [Man] illuminates.

3. The display reads "controller stop": All configured controllers are switched off.
- With configured two-position and continuous controllers, the actuating variable is set to 0.
 - With configured-limit contacts, the corresponding relay is switched off.

manual operation

controller
active

4. Press [Man] to return to automatic operation.
- The LED next to the button goes out.
 - The message "controller active" is shown on the display for five seconds.
 - After that, the device automatically returns to the menu from which the manual operation was started.

Note

Every time the manual-operation mode is entered, every single controller type must be activated again.

13.10.1 Manual operation with configured two-position and continuous controllers

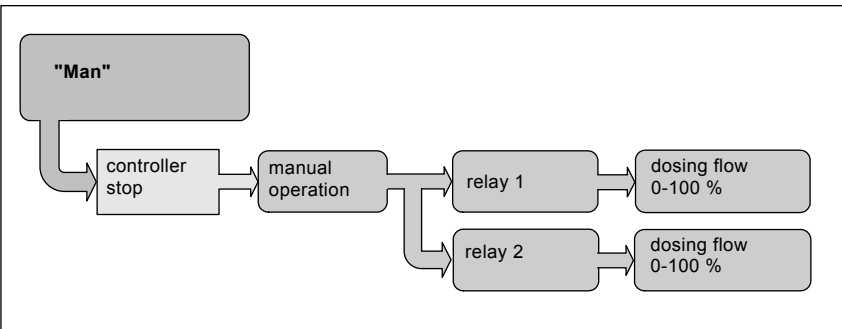


Fig. 32 Manual operation with configured two-position and continuous controllers

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With configured two-position controllers, the relay outputs 1 and 2 as well as the output "cont. controller" can be separately run manually. By selecting the desired relay output, the dosing flow of the pump/pumps can be changed.

manual operation

controller

stop

- Having switched to manual operation, the message "controller stop" is displayed for five seconds.
 - All controllers are switched off.
 - The final control elements are closed (set to 0).

manual operation

0.01 mg/l

1

5.20 pH c

22 °C c

- After that, the device automatically switches to the mode "display measured value" (first line: "manual operation").
 - The controller control display is shown on the right side of the display window. Either control field 1 is present for relay 1, or there is a field for the continuous controller.
- See section [13.6.3 Controller control fields on the display](#).
- Since switching to manual operation will cause all controllers to be switched off, none of the control fields are filled (there are no areas displayed inversely).

- Press [OK] to switch to the subsequent menu.

Three options are available:

 - relay output 1
 - relay output 2
 - continuous controller.

manual operation

relay output 1

relay output 2

cont. controller

- Select relay output 1 using the [Up] and [Down] buttons. Press [OK] to switch to the corresponding menu.
- Set the desired dosing rate of the pump using the [Up] and [Down] buttons.

relay 1

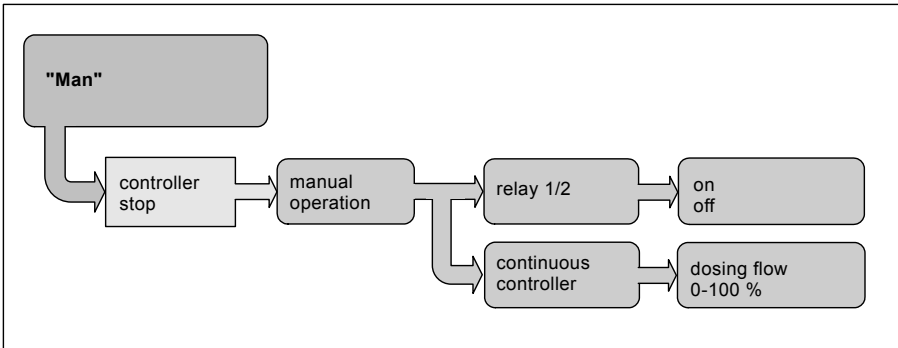
0 %

dosing flow

- For relay output 2 and the output continuous controller, proceed similarly to relay output 1.
 - Press [OK] to start the controller at the selected dosing flow.
 - The display shows the controller control display in its dependence on the selected dosing flows.
- See section [13.6.3 Controller control fields on the display](#).

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13.10.2 Manual operation with configured limit contact and continuous controller



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Fig. 33 Manual operation with configured limit contact and continuous controller

Manual operation with configured limit contacts is largely similar to manual operation with two-position and continuous controllers.

The difference: When the desired relay output is selected, the relay can be switched on or off.

Press [OK] to start the controller.

- The display shows the controller control display which depends on the switching state of the relay or the selected dosing flow with continuous control.

See section [13.6.3 Controller control fields on the display](#).

14. Fault finding

Note

Faults during the measurement, see installation and operating instructions for the electrode or measuring cell.

Fault	Cause	Remedy
1. No display following start-up.	a) No power supply.	Connect the power supply.
2. With pH measurement: Display permanently indicates pH approximately 7. – With measurement of oxidisers: Display permanently indicates zero.	a) Short-circuit in cable between measuring cell and instrument amplifier, moisture in connectors.	Check the connection cable and eliminate short-circuit and moisture.
3. Display permanently at full-scale value.	a) Open circuit in cable between measuring cell and instrument amplifier.	Check the connection cable and reestablish connection.
4. Display with measured value unsteady.	a) Interferences on cable from electrode/measuring cell.	Check that the display is properly connected.
	b) pH and redox measurement: air in sample-water flow.	Check the sample-water supply system (pipes, etc.) and make changes, if necessary.
	c) pH measurement: sample-water flow interrupted.	Check the sample-water supply system (pipes, etc.) and make changes, if necessary.
	d) Cable between electrode/ measuring cell and instrument amplifier broken.	Check the connection cable and reestablish connection.
	e) Sensor/electrode faulty.	Replace the sensor/electrode.
5. With measurement of oxidisers: insufficient sensitivity of measuring cell.	a) Measuring cell contaminated or passivated by deposits.	Disassemble the measuring cell, and clean the electrode surface.
6. With pH measurement: Display with measured value reacts extremely slowly.	a) Electrode aged.	Replace the electrode.
	b) Electrode dirty.	Clean the electrode.
7. With pH measurement: error message during calibration.	a) Wrong buffer solution used.	Use the correct buffer solution.
	b) Electrode aged.	Replace the electrode.
	c) Electrode dirty.	Clean the electrode.
8. Device cannot be set.	a) Incorrect code set (device protected against adjustment).	See section 13.5.8 Code function .
9. Faulty control.	a) Device is incorrectly parameterised.	Check the settings and match them to the local conditions. If necessary, reset the device to the factory settings.

15. Maintenance

The device is maintenance-free.

Repairs can only be carried out in the factory by authorised personnel.

16. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use appropriate private waste collection services.
2. If this is not possible, contact the nearest Grundfos or Grundfos Alldos company or service workshop.

Subject to alterations.

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15.730023 V5.0	GB
Repl. 15.730023 V4.0	
96681473 0309	

SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.15 Alldos Chemical Metering Pumps –Grundfos

Model # Grundfos Part #

DDI 2.5-10AR-PVC-P33/V/C-F-3133B

DDI 2.5-10AR-PVC-P33/V/C-F-3133B

DDI 5.5-10AR-PVC-P33/V/C-F-3133B

Tag # MP-411, MP-412, MP-413

GRUNDFOS ALLDOS INSTRUCTIONS

DDI 209

Dosing pump

Ⓞ GB Installation and operating instructions

REVIEWED ACCORDING TO THE
REQUIREMENTS OF THE GENERAL
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THESE
REQUIREMENTS.

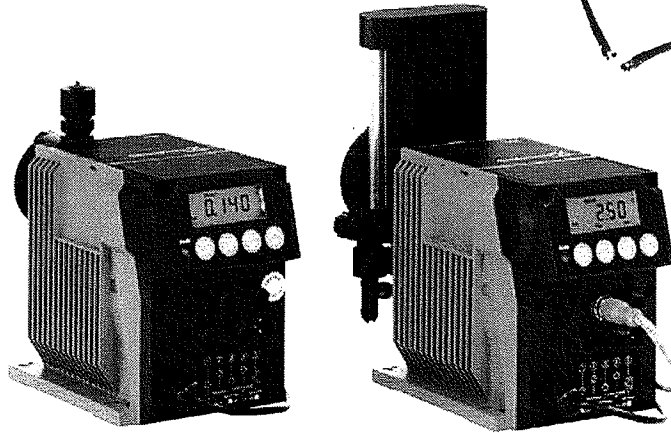
☒ REVIEWED

☐ MAKE NOTED CORRECTIONS

☐ REVISE & RESUBMIT

DATE: July 9,
2010

BY: K.B.



BE > THINK > INNOVATE >

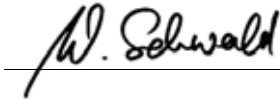
GRUNDFOS 
ALLDOS

Declaration of Conformity

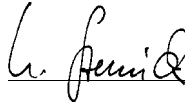
We **Grundfos Alldos** declare under our sole responsibility that the products **DDI 209**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to

- Machinery (98/37/EC).
Standard used: EN ISO 12100.
- Electromagnetic compatibility (89/336/EEC).
Standards used: EN 61000-3-2: 1995, + A1 + A2, EN 61000-3-3: 1995 and EN 61326: 1997, + A1 + A2, Class B.
- Electrical equipment designed for use within certain voltage limits (73/23/EEC) [95].
Standard used: EN 61010-1: 2002.

Pfinztal, 1st July 2008




W. Schwald
Managing Director



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Warning
These complete installation and operating instructions are also available on www.Grundfosalldos.com.
 *Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.*

1. General information

1.1 Introduction

These installation and operating instructions contain all the information required for starting up and handling the DDI 209 diaphragm dosing pump.

If you require further information or if any problems arise, which are not described in detail in this manual, please contact the nearest Grundfos Alldos company.

1.2 Service documentation

If you have any questions, please contact the nearest Grundfos Alldos company or service workshop.

1.3 Information about the product

1.3.1 Pump types

The DDI 209 dosing pump is available for a variety of performance ranges in various sizes:

Pump types
DDI 0.4-10
DDI 2.2-16
DDI 2.5-10
DDI 5.5-10
DDI 13.8-4
DDI 20-3

The following is indicated on the pump nameplate (see section [4.1 Identification](#)):

- The pump type which specifies the stroke volume, connection size and performance data (see below).
- The pump serial number which is used to identify the pump.
- The most important characteristics of the pump configuration, e.g. dosing head and valve materials. They are described in section [4.2 Type key](#).
- Maximum flow rate and maximum counter-pressure.
- Supply voltage or mains voltage and mains frequency.

Note *The pump for viscous liquids is called HV variant in the following.*

1.3.2 Connection size

Pump type	Connection size	HV variant
DDI 0.4-10	DN 4	DN 4
DDI 2.2-16	DN 4	DN 8
DDI 2.5-10	DN 4	DN 8
DDI 5.5-10	DN 4	DN 8
DDI 13.8-4	DN 8/10	DN 8
DDI 20-3	DN 8/10	DN 8

1.3.3 Pump performance

Performance data at maximum pump counter-pressure

Pump type	Normal operation				Slow-mode operation			
	Q **		p max.*	Max. stroke rate	Q **		p max.*	Max. stroke rate
	Standard	With Plus ³ system			Standard	With Plus ³ system		
	[l/h]	[l/h]			[l/h]	[l/h]		
DDI 0.4-10	0.4***	0.4***	10	180	0.26***	0.26***	10	120
DDI 2.2-16	2.2	1.9	16	180	1.5	1.2	16	120
DDI 2.5-10	2.5	2.2	10	180	1.7	1.4	10	120
DDI 5.5-10	5.5	4.9	10	180	3.7	3.2	10	120
DDI 13.8-4	13.8	—	4	180	9.2	—	4	120
DDI 20-3	20	—	3	180	13.3	—	3	120

- * Observe the maximum permissible temperatures and that the friction loss increases with the viscosity of the dosing medium.
- ** The maximum dosing flow of HV-variant pumps is up to 10 % lower.
- *** At counter-pressures lower than 10 bar, the maximum dosing flow of the DDI 0.4-10 gradually increases to up to 1 l/h.

Note

The pump can be operated in the range between 1 % and 100 % of the maximum dosing capacity.

Note

The maximum display indication is higher than the nominal capacity of the pump because it refers to the default setting.

1.3.4 Accuracy

- Applies to:
 - water as dosing medium
 - fully deaerated dosing head
 - standard pump version.
- Dosing flow fluctuation and linearity deviation:
± 1.5 % of the full-scale value.
- Construction tolerance: according to VDMA 24284.

1.3.5 Inlet pressure and counter-pressure / suction lift during operation

Maximum inlet pressure

Pump type	Operating conditions / version*		
	Normal operation	Slow-mode operation	With Plus ³ system
	[bar]	[bar]	[bar]
DDI 0.4-10 - DDI 5.5-10	2	2	No flooded suction, no positive inlet pressure!
DDI 13.8-4	2	2	—
DDI 20-3	1.5	1.5	—

* For pumps with pressure sensor (Flow Monitor pump option), the inlet pressure on the suction side must not exceed 1 bar.

Minimum counter-pressure at the pump discharge valve

Pump type	Operating conditions / version*
	All*
	[bar]
DDI 0.4-10 - DDI 20-3	1

* For pumps with pressure sensor (Flow Monitor pump option), the minimum system pressure is 2 bar and the minimum pressure difference between the suction and discharge sides is 2 bar. If the volume flow is not constant (as, for example, in the case of contact or analog control), even small volume flows should not fall below the minimum pressure or the minimum pressure difference.

Maximum suction lift* (start-up) for media with a viscosity similar to water

Pump type	Operating conditions / version	
	Continuous operation	Continuous operation with Plus ³ system
	[m]	[m]
DDI 0.4-10	Flooded suction	**
DDI 2.2-16	1.5	**
DDI 2.5-10	1.5	**
DDI 5.5-10	2.0	**
DDI 13.8-4	2.8	—
DDI 20-3	2.8	—

* Deaeration valve open.

** Pumps with Plus³ system are delivered with a special start-up device.

Maximum suction lift* (continuous operation) for non-degassing media with a viscosity similar to water

Pump type	Operating conditions / version			
	Normal operation	Slow-mode operation	Normal operation with Plus ³ system	Slow-mode operation with Plus ³ system
	[m]	[m]	[m]	[m]
DDI 0.4-10	Flooded suction	Flooded suction	1.5	1.5
DDI 2.2-16	4	6	1.5	1.5
DDI 2.5-10	4	6	1.5	1.5
DDI 5.5-10	4	6	1.5	1.5
DDI 13.8-4	3	3	—	—
DDI 20-3	3	3	—	—

* Dosing head and valves moistened.

1.3.6 Sound pressure level

45 dB(A), testing according to DIN 45635-01-KL3.

Note

At dosing capacities up to 10 % of the maximum dosing capacity of the pump, resonance noise may temporarily occur at the stepper motor.

1.3.7 Enclosure class

Caution

The enclosure class is only met if the sockets are protected! The data regarding the enclosure class applies to pumps with correctly inserted plugs or screwed-on caps.

- Pump with mains plug: IP65.
- Pump without mains plug: IP65 can only be ensured if the power supply cable is connected with IP65 protection.

1.3.8 Required energy

Power supply for AC voltage

- Rated voltage range: 110-240 V.
Deviation from the rated value: ± 10 %.
- Mains frequency: 50/60 Hz.
- Maximum input power: 20 W including all sensors (reduced input power according to pump type and connected sensors).

24 V DC power supply

- Supply voltage: 24 V.
Deviation from the rated value: ± 15 %.
- Quality of the DC voltage: smoothed, ripple below 3.6 V.
- Maximum input power: 20 W including all sensors (reduced input power according to pump type and connected sensors).

Note

The power supply must be electrically isolated from the signal inputs and outputs.

1.3.9 Ambient and operating conditions

- Permissible ambient temperature:
0 °C to +40 °C.
- Permissible storage temperature:
−10 °C to +50 °C.
- Permissible air humidity: max. relative humidity:
92 % (non-condensing).



Warning

The DDI 209 is NOT approved for operation in potentially explosive areas!

The installation site must be under cover!

Ensure that the enclosure class of motor and pump is not affected by the atmospheric conditions.

Caution

*Pumps with electronics are only suitable for indoor use!
Do not install outdoors!*

1.3.10 Dosing medium

Caution *In the event of questions regarding the material resistance and suitability of the pump for specific dosing media, please contact Grundfos Alldos.*

The dosing medium must have the following basic characteristics:

- liquid
- non-abrasive
- non-inflammable.

For degassing dosing media, note the following:

- The DDI 209 without Plus³ system can be used in flooded suction for moderately degassing media such as chlorine bleaching agents. See section [5. Installation](#).
- The DDI 209 with Plus³ system can be used for moderately degassing media such as chlorine bleaching agents. Using the DDI 5.5-10 with Plus³ system at a maximum system pressure of 3 bar, H₂O₂ up to a maximum of 31 % can be dosed. No flooded suction!

Maximum permissible viscosity at operating temperature*

Pump type	Maximum viscosity*			
	Normal operation	Slow-mode operation	Normal operation with Plus ³ system	Slow-mode operation with Plus ³ system
	[mPa s]	[mPa s]	[mPa s]	[mPa s]
DDI 0.4-10 - DDI 2.5-10	200	200	200	200
DDI 5.5-10	100	200	100	200
DDI 13.8-4 - DDI 20-3	100	200	—	—
Pump type	HV variant			
DDI 0.4-10	500	1000	500	500
DDI 2.2-16 - DDI 2.5-10	200	1000	—	—
DDI 5.5-10 - DDI 20-3	200	500	—	—

* The stated values are approximate values and apply to Newtonian liquids.
Note that the viscosity increases with decreasing temperature!

Permissible media temperature

Dosing head material	Min. media temperature	Max. media temperature	
		p < 10 bar	p < 16 bar
	[°C]	[°C]	[°C]
PVC	0	40	20
Stainless steel, DIN 1.4571*	-10	70	70
PP	0	40	20
PVDF**	-10	60*	20

* A temperature of 120 °C at a counter-pressure of max. 2 bar is permitted for a short period (15 minutes).
** At 70 °C, the maximum counter-pressure is 3 bar.



Warning
Observe the manufacturer's safety instructions when handling chemicals!

Caution

The dosing medium must be in liquid form!
Observe the freezing and boiling points of the dosing medium!

Caution

The resistance of the parts that come into contact with the media depends on the media, media temperature and operating pressure. Ensure that parts in contact with the media are chemically resistant to the dosing medium under operating conditions!
Make sure that the pump is suitable for the actual dosing medium!

1.4 Applications

1.4.1 Appropriate, acceptable and correct usage

The DDI 209 pump is suitable for liquid, non-abrasive and non-inflammable media strictly in accordance with the instructions in this manual.



Warning
Other applications or the operation of pumps in ambient and operating conditions, which are not approved, are considered improper and are not permitted. Grundfos Alldos accepts no liability for any damage resulting from incorrect use.

1.5 Warranty

Warranty in accordance with our general terms of sale and delivery is only valid

- if the pump is used in accordance with the information within this manual.
- if the pump is not dismantled or incorrectly handled.
- if repairs are carried out by authorised and qualified personnel.
- if original spare parts are used for repairs.

2. Safety

This manual contains general instructions that must be observed during installation, operation and maintenance of the pump. This manual must therefore be read by the installation engineer and the relevant qualified personnel/operators prior to installation and start-up, and must be available at the installation location of the pump at all times.

It is not only the general safety instructions given in this "Safety" section that must be observed, but also all the specific safety instructions given in other sections.

2.1 Identification of safety instructions in this manual

If the safety instructions or other advice in this manual are not observed, it may result in personal injury or malfunction and damage to the pump. The safety instructions and other advice are identified by the following symbols:



Warning
If these safety instructions are not observed, it may result in personal injury!

Caution

If these safety instructions are not observed, it may result in malfunction or damage to the equipment!

Note

Notes or instructions that make the job easier and ensure safe operation.

Information provided directly on the pump, e.g. labelling of fluid connections, must be observed and must be maintained in a readable condition at all times.

2.2 Marking at the pump

The pumps with Plus³ system are provided with the following danger notice:

Beware of caustic liquids!
Risk of causticisation by the dosing medium!



If the pump is filled, keep the cover closed and do not touch inside the priming chamber!
Before dismantling and transporting the pump, empty the priming chamber completely and clean it, if necessary!

2.3 Qualification and training of personnel

The personnel responsible for the operation, maintenance, inspection and installation must be appropriately qualified for these tasks. Areas of responsibility, levels of authority and the supervision of the personnel must be precisely defined by the operator.

If the personnel do not have the necessary knowledge, the necessary training and instruction must be given. If necessary, training can be performed by the manufacturer/supplier at the request of the operator of the pump. It is the responsibility of the operator to make sure that the contents of this manual are understood by the personnel.

2.4 Risks when safety instructions are not observed

Non-observance of the safety instructions may have dangerous consequences for the personnel, the environment and the pump. If the safety instructions are not observed, all rights to claims for damages may be lost.

Non-observance of the safety instructions may lead to the following hazards:

- failure of important functions of the pump/system
- failure of specified methods for maintenance
- harm to humans from exposure to electrical, mechanical and chemical influences
- damage to the environment from leakage of harmful substances.

2.5 Safety-conscious working

The safety instructions in this manual, applicable national health and safety regulations and any operator internal working, operating and safety regulations must be observed.

2.6 Safety instructions for the operator/user

Hazardous hot or cold parts on the pump must be protected to prevent accidental contact.

Leakages of dangerous substances (e.g. hot, toxic) must be disposed of in a way that is not harmful to the personnel or the environment. Legal regulations must be observed.

Damage caused by electrical energy must be prevented (for more details, see for example the regulations of the VDE and the local electricity supply company).

2.7 Safety instructions for maintenance, inspection and installation work

The operator must ensure that all maintenance, inspection and installation work is carried out by authorised and qualified personnel, who have been adequately trained by reading this manual.

All work on the pump should only be carried out when the pump is stopped. The procedure described in this manual for stopping the pump must be observed.

Pumps or pump units which are used for media that are harmful to health must be decontaminated.

All safety and protective equipment must be immediately restarted or put into operation once work is complete.

Observe the points described in the initial start-up section prior to subsequent start-up.



Warning

Electrical connections must only be carried out by qualified personnel!

The pump housing must only be opened by personnel authorised by Grundfos Aillos!

2.8 Unauthorised modification and manufacture of spare parts

Modification or changes to the pump are only permitted following agreement with the manufacturer. Original spare parts and accessories authorised by the manufacturer are safe to use. Using other parts can result in liability for any resulting consequences.

2.9 Improper operating methods

The operational safety of the supplied pump is only ensured if it is used in accordance with section [1. General information](#). The specified limit values must under no circumstances be exceeded.

2.10 Safety of the system in the event of a failure in the dosing system

DDI 209 dosing pumps are designed according to the latest technologies and are carefully manufactured and tested. However, a failure may occur in the dosing system. Systems in which dosing pumps are installed must be designed in such a way that the safety of the entire system is still ensured following a failure of the dosing pump. Provide the relevant monitoring and control functions for this.

3. Transport and intermediate storage

3.1 Transport

Caution *Do not throw or drop the pump.*

3.2 Delivery

The DDI 209 dosing pump is delivered in a cardboard box. Place the pump in the packaging during transport and intermediate storage.

3.3 Unpacking

Retain the packaging for future storage or return, or dispose of the packaging in accordance with local regulations.

3.4 Intermediate storage

- Permissible storage temperature:
-10 °C to +50 °C.
- Permissible air humidity: max. relative humidity:
92 % (non-condensing).

3.5 Return

Return the pump in its original packaging or equivalent.

The pump must be thoroughly cleaned before it is returned or stored. It is essential that there are no traces of toxic or hazardous media remaining on the pump.

Caution *Grundfos Alldos accepts no liability for damage caused by incorrect transportation or missing or unsuitable packaging of the pump!*

Before returning the pump to Grundfos Alldos for service, the **safety declaration** at the end of these instructions must be filled in by authorised personnel and attached to the pump in a visible position.

Caution *If a pump has been used for a medium which is injurious to health or toxic, the pump will be classified as contaminated.*

If Grundfos Alldos is requested to service the pump, it must be ensured that the pump is free from substances that can be injurious to health or toxic. If the pump has been used for such substances, the pump must be cleaned before it is returned.

If proper cleaning is not possible, all relevant information about the chemical must be provided.

If the above is not fulfilled, Grundfos Alldos can refuse to accept the pump for service. Possible costs of returning the pump are paid by the customer.

The safety declaration can be found at the end of these instructions.

Caution *The replacement of the power supply cable must be carried out by an authorised Grundfos Alldos service workshop.*

4. Technical data

4.1 Identification

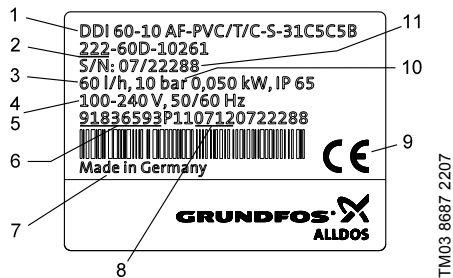


Fig. 1 DDI 209 nameplate

Pos.	Description
1	Type designation
2	Model
3	Maximum capacity [l/h]
4	Voltage [V]
5	Frequency [Hz]
6	Product number
7	Country of origin
8	Year and week code
9	Marks of approval, CE mark, etc.
10	Maximum pressure [bar]
11	Serial number

4.2 Type key

Example: DDI 2- 16 AR PVC /V /G -F -3 1 3 B1 B

Type range

DDI

Maximum flow [l/h]

Maximum counter-pressure [bar]

Control variant

AR Standard
AF AR with Flow Monitor
AP AR with PROFIBUS
APF AR with Flow Monitor and PROFIBUS

Dosing head variant

PP Polypropylene
PV PVDF (polyvinylidene fluoride)
PVC Polyvinyl chloride
SS Stainless steel, DIN 1.4401
PP-P3 PP with Plus³ system
PVC-P3 PVC with Plus³ system
PP-L PP + integrated diaphragm leakage detection
PV-L PV + integrated diaphragm leakage detection
PVC-L PVC + integrated diaphragm leakage detection
SS-L SS + integrated diaphragm leakage detection

Gasket material

E EPDM
V FKM
T PTFE

Valve ball material

C Ceramics
G Glass
T PTFE
SS Stainless steel, DIN 1.4401

Control panel position

F Front-mounted
T Top-mounted

Supply voltage

3 1 x 100-240 V, 50/60 Hz
I 24 V DC

Mains plug

X No plug
F EU (Schuko)
B USA, Canada
I Australia, New Zealand, Taiwan
E Switzerland

Connection, suction/discharge

B6 Pipe, 4/6 mm
3 Tube, 4/6 mm
A5 Tube, 5/8 mm
4 Tube, 6/9 mm
6 Tube, 9/12 mm
C4 Tube, 1/8" / 1/4"
R Tube, 1/4" / 3/8"
S Tube, 3/8" / 1/2"
A Threaded, Rp 1/4, female
V Threaded, 1/4" NPT, female
A9 Threaded, 1/2" NPT, male
B1 Tube, 6/12 mm/
cementing d. 12 mm
B2 Tube, 13/20 mm/
cementing d. 25 mm

Valve type

1 Standard
2 Spring-loaded
0.05 bar suction opening pressure;
0.05 bar discharge opening pressure
3 Spring-loaded
0.05 bar suction opening pressure;
0.8 bar discharge opening pressure
4 Spring-loaded, discharge side only
0.8 bar opening pressure

4.3 General description

The DDI 209 is a dosing pump with a stepper motor and electronic power control. The pump is operated via the diagonal or horizontal display in a user-friendly menu structure.

The DDI 209 is available in various versions. See also section 1. General information.

In the general description, a distinction is made between pumps with dosing heads with the following features:

- manual deaeration (standard)
- Plus³ system
- diaphragm leakage detection.

4.3.1 DDI 209 with manual deaeration

Option:

The pump can also be equipped with the following:

- Flow Monitor
- interface for PROFIBUS.

The functions are described, but only apply to the relevant pump version.

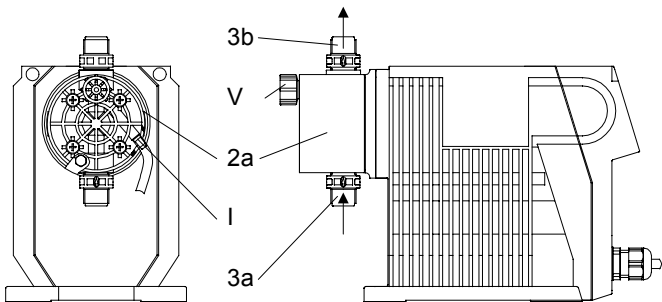


Fig. 2 DDI 209 with manual deaeration

Pos. Components	
3a	Suction valve
3b	Discharge valve
2a	Dosing head with manual deaeration
I	Connection for deaeration line
V	Deaeration screw for manual deaeration

TM03 6589 4506

4.3.2 DDI 209 Plus³ system with priming and calibration system for moderately degassing liquids (chlorine bleaching agents) (only for DDI 209 0.4-10 to DDI 209 5.5-10)

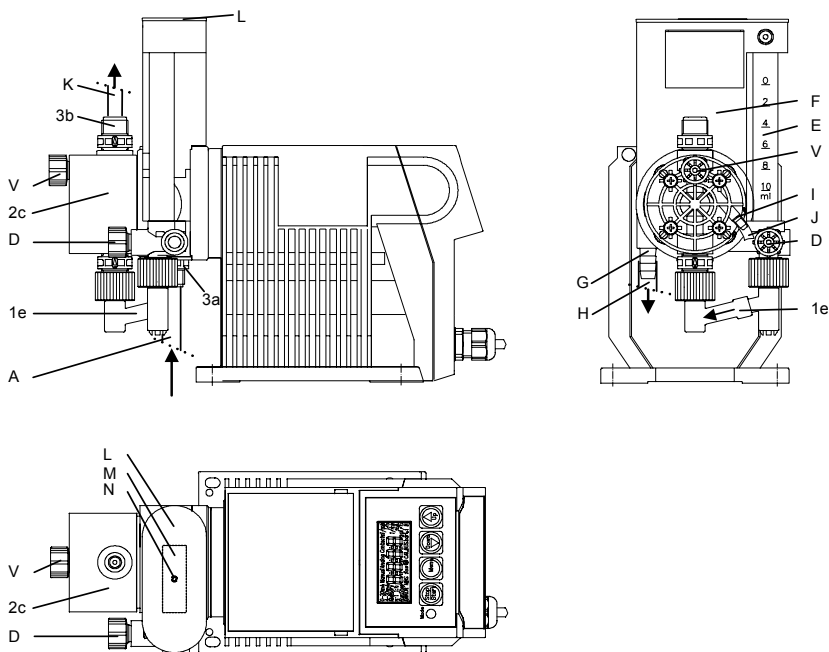


Fig. 3 DDI 209 Plus³ system

Pos.	Components
3a	Suction valve
3b	Discharge valve
2c	Dosing head Plus ³ system
I	Connection for deaeration line
V	Deaeration screw
A	Suction line from tank
1e	Line from calibration tube (E) to dosing head (2c)
D	Isolating valve at calibration tube (E)
E	Calibration tube
F	Priming chamber
G	Connection for overflow line (H)
H	Overflow line to tank (PVC tube 8/11)
J	Deaeration line to tank
K	Discharge line
L	Cover
M	Adhesive label
N	Deaeration hole

4.3.3 Functional principle of the Plus³ system

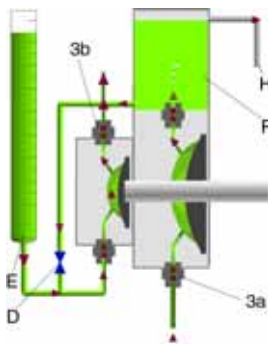
Plus³ system in operation:

- The priming chamber (F) is filled with the dosing medium via the suction valve (3a).
 - The calibration tube (E) is filled from the priming chamber.
 - Unused dosing medium flows back into the tank via the overflow line (H).
- The dosing medium flows from the calibration tube (E) to the discharge valve (3b) via the small dosing diaphragm.

Note

The isolating valve (D) must be open during operation!

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TM03 6214 4506

Fig. 4 Functional principle of the Plus³ system

4.3.4 DDI 209 with diaphragm leakage detection

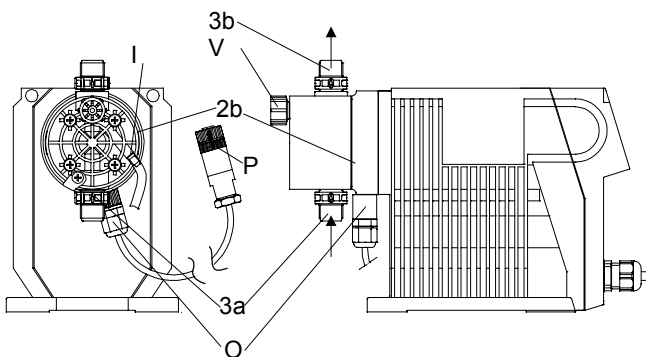


Fig. 5 DDI 209 with diaphragm leakage detection

Pos.	Components
3a	Suction valve
3b	Discharge valve
2b	Dosing head with flange for diaphragm leakage detection
I	Connection for deaeration line
V	Deaeration screw for manual deaeration
O	Opto-sensor
P	M12 plug for socket 1

TM03 6591 4506

4.3.5 Functional principle of diaphragm leakage detection

Pumps with diaphragm leakage detection (MLS) have a special dosing head flange for an optoelectronic sensor. The pump is supplied with the diaphragm leakage sensor (MLS) already installed.

The optoelectronic sensor contains:

- infrared transmitter
- infrared receiver.



TM03 6216 4506

Fig. 6 Diaphragm leakage sensor (MLS)

If the diaphragm leaks,

- the liquid enters the dosing head flange.
- the light refraction changes.
- the sensor emits a signal.

The electronics operates two contacts, which can be used, for example, to trigger an alarm signal or to switch off the pump.

4.3.6 Flow Monitor for dosing control

The pressure sensor (Flow Monitor pump option) is used as a dosing controller and to monitor the pressure for the whole power ranges.

The Flow Monitor for dosing control consists of a pressure sensor integrated in the dosing head.

The pressure sensor is available as Flow Monitor pump option. The pressure sensor is fitted to the pump on delivery. Upgrades are not possible.

Note

Pressure control is primarily used to protect the pump. This function is not a substitute for the overflow valve.

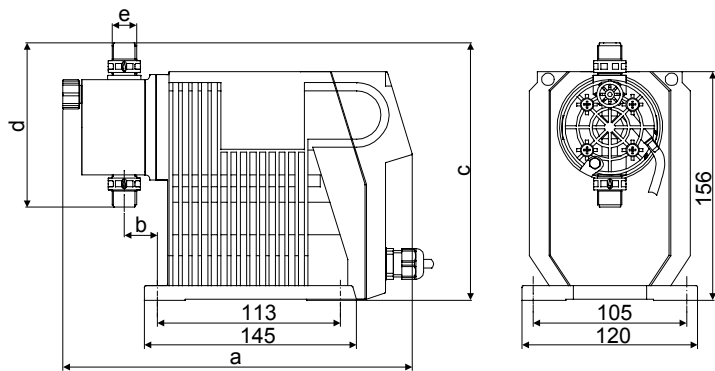
4.3.7 HV variant for liquids which are more viscous than water

All HV-variant pumps are equipped with spring-loaded valves, some have a larger nominal diameter and adapters.

Note

Note that the HV-variant pump has other dimensions and that other connection line dimensions might be required!

4.4 Dimensional sketches



TM03 6592 4506

Fig. 7 DDI 209
Dimensions for DDI 209

	a [mm]	b [mm]	c [mm]	d [mm]	e	c HV [mm]	d HV [mm]	e HV
DDI 0.4-10	239	23	175.5	112	G 3/8	175.5	112	G 3/8
DDI 2.2-16	239	23	175.5	112	G 3/8	207.5	176	G 5/8
DDI 2.5-10	239	23	175.5	112	G 3/8	207.5	176	G 5/8
DDI 5.5-10	239	23	175.5	112	G 3/8	207.5	176	G 5/8
DDI 13.8-4	240	29	185	133	G 5/8	185	133	G 5/8
DDI 20-3	240	29	185	133	G 5/8	185	133	G 5/8

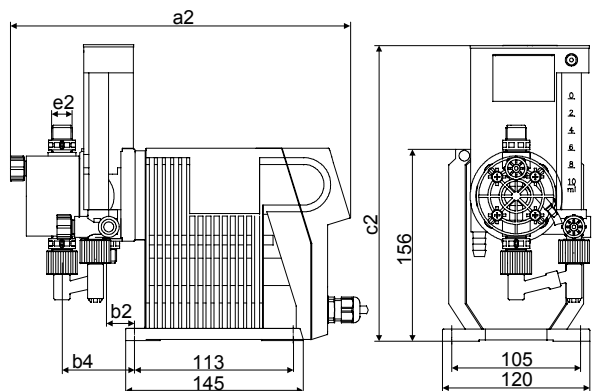


Fig. 8 DDI 209 with Plus³ system

Dimensions for DDI 209 with Plus³ system (only DDI 0.4-10 - DDI 5.5-10)

	a2 [mm]	b2 [mm]	c2 [mm]	d2 [mm]	e2
DDI 0.4-10	276	25	61	240	G 3/8
DDI 2.2-16	276	25	61	240	G 3/8
DDI 2.5-10	276	25	61	240	G 3/8
DDI 5.5-10	276	25	61	240	G 3/8

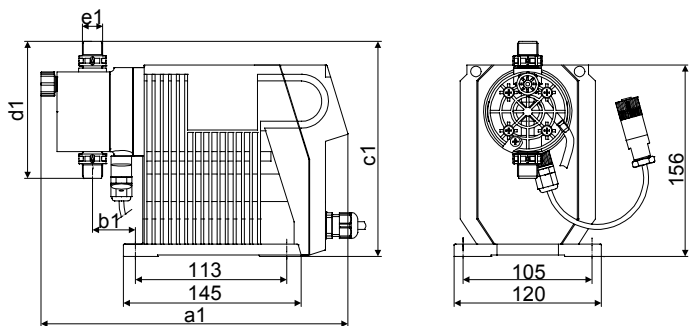


Fig. 9 DDI 209 with diaphragm leakage detection

Dimensions for DDI 209 with diaphragm leakage detection

	a1 [mm]	b1 [mm]	c1 [mm]	d1 [mm]	e1	c1 HV [mm]	d1 HV [mm]	e1 HV
DDI 0.4-10	250	34	175.5	112	G 3/8	175.5	112	G 3/8
DDI 2.2-16	250	34	175.5	112	G 3/8	207.5	176	G 5/8
DDI 2.5-10	250	34	175.5	112	G 3/8	207.5	176	G 5/8
DDI 5.5-10	250	34	175.5	112	G 3/8	207.5	176	G 5/8
DDI 13.8-4	251	40	185	133	G 5/8	185	133	G 5/8
DDI 20-3	251	40	185	133	G 5/8	185	133	G 5/8

4.5 Weight

Pump type	Dosing head material	Weight [kg]
DDI 0.4-10 - DDI 2.5-10	PVC, PP, PVDF	2.3
DDI 0.4-10 - DDI 2.5-10	Stainless steel, DIN 1.4571	3.5
DDI 5.5-10	PVC, PP, PVDF	2.4
DDI 5.5-10	Stainless steel, DIN 1.4571	3.6
DDI 13.8-4 - DDI 20-3	PVC, PP, PVDF	2.6
DDI 13.8-4 - DDI 20-3	Stainless steel, DIN 1.4571	3.6

4.6 Materials

Pump housing material

Pump and control unit housing: s PS FR GF 22 (glass-fibre-reinforced polystyrene).

Pressure sensor (Flow Monitor)

Sensor: Aluminium oxide Al_2O_3 (96 %).

O-rings: FKM, EPDM or PTFE.



Warning

Observe the manufacturer's safety instructions when handling chemicals!

The resistance of the parts that come into contact with the media depends on the media, media temperature and operating pressure. Ensure that parts in contact with the medium are chemically resistant to the dosing medium under operating conditions!

Caution

Further information on resistance with regard to the media, media temperature and operating pressure is available on request.

Note

4.7 Control unit

Functions of pumps with control unit

- "continuous operation" button for function test and dosing head deaeration
- memory function (stores a maximum of 65,000 pulses)
- two-stage tank-empty signal (e.g. via Grundfos Alldos tank-empty sensor)
- stroke signal/pre-empty signal (adjustable)
- dosing controller function (only with sensor – optional)
- diaphragm leakage detection (only with sensor – optional)
- access-code-protected settings
- remote on/off
- Hall sensor (for motor monitoring)
- calibration (adjust the pump to local operating conditions)
- dosing capacity display (can be reset)
- operating hours counter (cannot be reset)
- interface: PROFIBUS (optional).

Operating modes:

- manual input/display of the dosing flow in l/h or gal/h. Quasi continuous dosing (short suction stroke, dosing stroke as long as possible).
- contact signal control input/display in ml/contact, most constant dosing
- current signal control 0-20 mA / 4-20 mA Adjustment of volumetric flow proportional to the current signal (displayed in l/h). Weighting of current input/output.
- batch dosing setting the dosing capacity and dosing flow per batch triggered manually or by an external contact signal
- batch dosing with timer functions
 - setting the dosing capacity and dosing flow per batch
 - setting the start time for first batch
 - setting the repeat time for subsequent batches.
- slow mode (for viscous media) long suction stroke.

Inputs and outputs

Inputs	
Contact signal	Maximum load: 12 V, 5 mA Minimum pulse length: 10 ms Minimum pause time: 20 ms
Current 0-20 mA	Maximum load: 22 Ω
Remote on/off	Maximum load: 12 V, 5 mA
Tank-empty signal	Maximum load: 12 V, 5 mA
Dosing controller and diaphragm leakage sensor	
Outputs	
Current 0-20 mA	Maximum load: 350 Ω
Error signal	Maximum ohmic load: 50 VDC / 75 VAC, 0.5 A
Stroke signal	Contact time/stroke: 200 ms
Pre-empty signal	Maximum ohmic load: 50 VDC / 75 VAC, 0.5 A

4.7.1 Interface (optional)

- PROFIBUS.

5. Installation

5.1 General information on installation

Warning



Observe the specifications for the installation location and range of applications described in sections **1. General information** and **5.2 Installation location**.

Warning



Faults, incorrect operation or faults on the pump or system can, for example, lead to excessive or insufficient dosing, or the permissible pressure may be exceeded. Consequential faults or damage must be evaluated by the operator and appropriate precautions must be taken to avoid them!

Caution

The DDI 0.4-10 (not with Plus³ system) should be operated with flooded suction!

5.2 Installation location

5.2.1 Space required for operation and maintenance

Note

The pump must be installed in a position where it is easily accessible during operation and maintenance work.

The control elements must be easily accessible during operation.

Maintenance work on the dosing head and the valves must be carried out regularly.

Provide sufficient space for removing the dosing head and the valves.

5.2.2 Permissible ambient influences

Permissible ambient temperature: 0 °C to +40 °C.

Permissible air humidity: max. relative humidity:

92 % (non-condensing).

The installation site must be under cover!

Ensure that the enclosure class of motor and pump is not affected by the atmospheric conditions.

Caution

**Pumps with electronics are only suitable for indoor use!
Do not install outdoors!**

5.2.3 Mounting surface

The pump must be mounted on a flat surface.

5.3 Mounting

Caution

Carefully tighten the screws, otherwise the plastic housing may be damaged.

5.3.1 Horizontal mounting

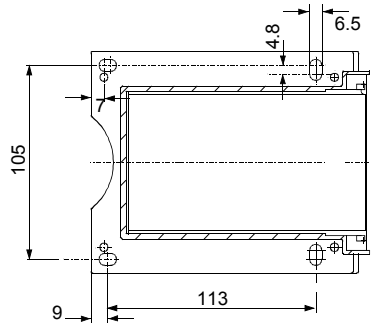


Fig. 10 Drilling scheme

- Use four M6 screws to mount the pump on the tank or on a console so that the suction valve is at the bottom and the discharge valve is at the top (dosing always flows upwards).

5.3.2 Vertical mounting

Note

Pumps with Plus³ system must not be mounted vertically!

1. Mount the pump on a vertical surface (e.g. a wall) using four M6 screws.
2. Unscrew the dosing head (four inner dosing head screws (1q + 2q)).
3. Turn the intermediate ring (4q) so that the discharge hole points downwards.
4. Turn the dosing head 90 ° so that the suction valve is at the bottom and the discharge valve is at the top (dosing always flows upwards).
5. Cross-tighten the screws using a torque wrench.
Maximum torque:
DDI 0.4 - DDI 5.5: 2.1 Nm.
DDI 13.8 - DDI 20: 2.5 Nm.

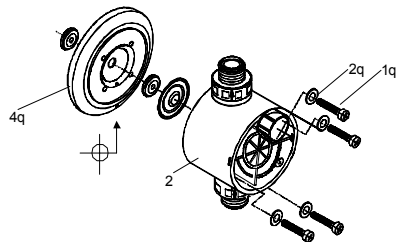


Fig. 11 Vertical mounting

5.3.3 Diaphragm leakage detection

With diaphragm leakage detection:

- Screw the sensor from the bottom into the opening in the dosing head flange.

5.4 Installation examples

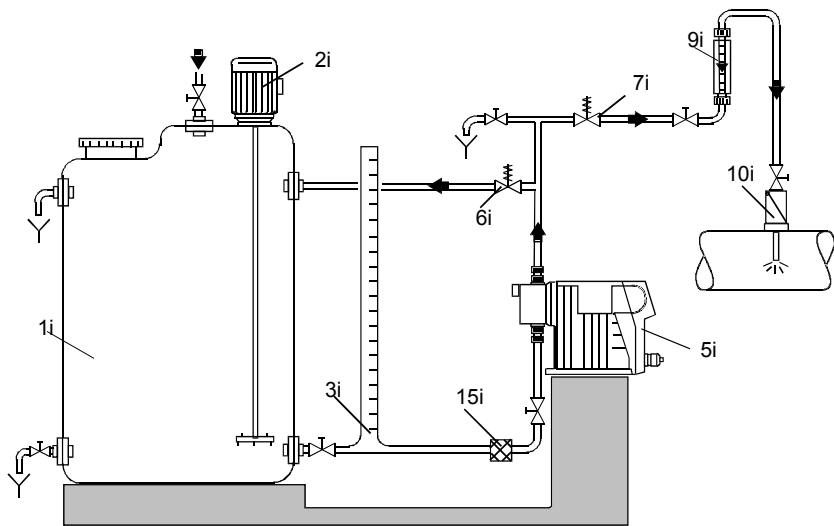


Fig. 12 Installation example of pump with manual deaeration

Pos.	Components
1i	Dosing tank
2i	Electric agitator
3i	Extraction device
5i	Dosing pump
6i	Relief valve
7i	Pressure-loading valve
9i	Calibration tube
10i	Injection unit
15i	Filter

- For pumps with Plus³ system:
- No flooded suction!
 - Minimum injection pressure on the discharge side.
 - The pressure at the discharge valve must be at least 1 bar higher than the pressure at the suction valve.

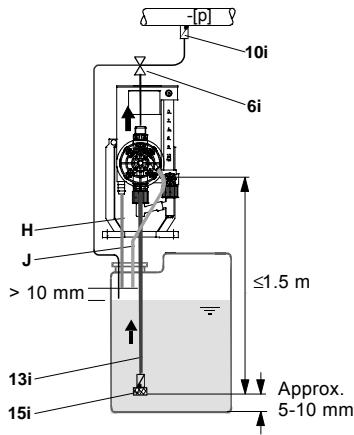


Fig. 13 Installation example of pump with Plus³ system

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5.5 Installation tips

- For non-degassing media with a viscosity similar to water, the pump can be mounted on the tank (observe the permissible suction lift).
- Flooded suction preferred (not possible with Plus³ system).
- For media with a tendency to sedimentation, install the suction line with filter (15i) so that the suction valve remains a few millimetres above the possible level of sedimentation.

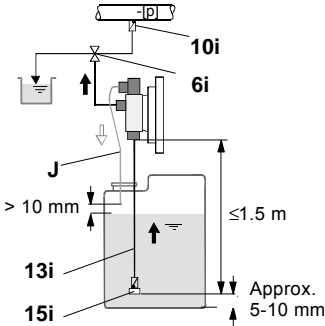


Fig. 14 Tank installation

With open outflow of the dosing medium or low counter-pressure

A positive pressure difference of at least 1 bar must be ensured between the counter-pressure at the injection point and the pressure of the dosing medium at the pump suction valve.

- If this cannot be ensured, install a pressure-loading valve (7i) immediately before the outlet or the injection unit.

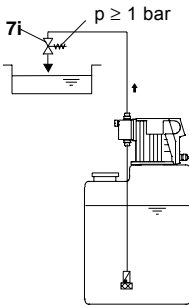


Fig. 15 Installation with pressure-loading valve

- To avoid the siphon effect, install a pressure-loading valve (7i) in the discharge line and, if necessary, a solenoid valve (14i) in the suction line.

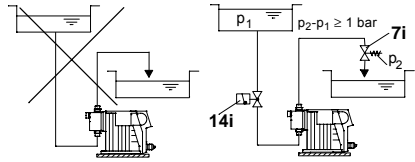


Fig. 16 Installation to avoid the siphon effect

- To protect the dosing pump against excessive pressure build-up, install a relief valve (6i) in the discharge line.
- For degassing media:
 - Flooded suction (not with Plus³ system).
 - Install a filter (15i) in the suction line to prevent the valves being contaminated.

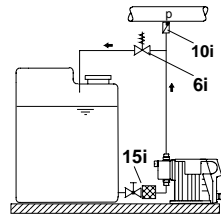


Fig. 17 Installation with relief valve and filter

- When installing the suction line, observe the following:
 - Keep the suction line as short as possible. Prevent it from becoming tangled.
 - If necessary, use swept bends instead of elbows.
 - Always route the suction line up towards the suction valve.
 - Avoid loops as they may cause air bubbles.

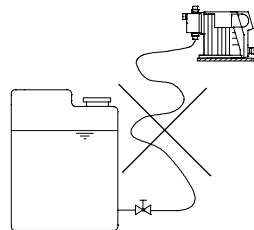


Fig. 18 Installation of suction line

- In the case of long discharge lines, install a non-return valve (12i) in the discharge line.

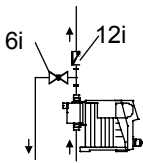


Fig. 19 Installation with non-return valve

5.6 Tube / pipe lines

5.6.1 General

Warning

To protect the dosing pump against excessive pressure build-up, install a relief valve in the discharge line.

All lines must be free from strain! Avoid loops and buckles in the tubes! Keep the suction line as short as possible!

The flow must run in the opposite direction to gravity!

Observe the manufacturer's safety instructions when handling chemicals!

The resistance of the parts that come into contact with the media depends on the media, media temperature and operating pressure. Ensure that parts in contact with the media are chemically resistant to the dosing medium under operating conditions!

Only use the specified line types!

Caution

With Plus³ system

- Use the suction line with foot valve and empty signal.
- For degassing media, maintain a maximum suction lift of 1.5 m.
- Open the isolating valve on the calibration system.

Maximum suction line length

- 5 m for standard pumps or pumps with Plus³ system when dosing media with a viscosity similar to water.
- 1.2 m when dosing media with a higher viscosity than water.

5.6.2 Sizing of tube / pipe lines

Warning

PVC tube DN 4 is not suitable for use as a discharge line!

Connect PE tube DN 4 on the discharge side!



Warning

Observe the pressure stage of the used lines. The maximum permissible inlet pressure and the pressure stage of the discharge lines must not be exceeded!

Minimum internal diameter

Pump type	Pump version	
	Standard	HV variant
	[mm]	[mm]
DDI 0.4-10	4	Suction side: 5 Discharge side: 4
DDI 2.2-16		
DDI 2.5-10	4	6
DDI 5.5-10		
DDI 13.8-4	6	Suction side: 9 Discharge side: 6
DDI 20-3		

5.6.3 Connecting the suction and discharge lines

- Connect the suction line to the suction valve (3a).
 - Install the suction line in the tank so that the foot valve remains approximately 5 to 10 mm above the bottom of the tank or the possible level of sedimentation.
- Connect the discharge line to the discharge valve (3b).

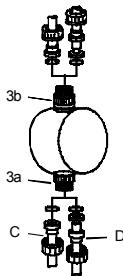


Fig. 20 Connecting the suction and discharge lines

Pos.	Components
3a	Suction valve
3b	Discharge valve
C	Pipe connection
D	Tube connection



5.6.4 Connecting the overflow and deaeration lines



Warning
Observe chemical resistance!

Note

HV-variant pumps have an assisting suction. In this case, prepare (cut) the deaeration line, but do not connect it yet!

The pump has a deaeration line (PVC 4/6).

- Connect the deaeration line (J) to the connection for the deaeration line (I).

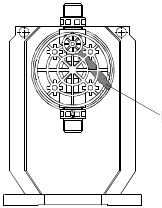


Fig. 21 Connection for the deaeration line

For pumps with Plus³ system

The pump has a deaeration line (PVC 4/6).

- Connect the deaeration line (J) to the connection for the deaeration line (I).
- Connect the overflow line (H) (PVC tube 8/11) to the connection (G).

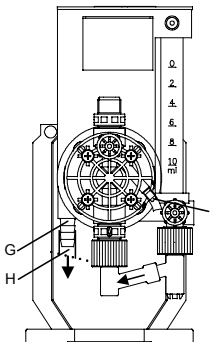


Fig. 22 Plus³ system

5.6.5 Installing the overflow and deaeration lines

- Shorten the overflow line (H) and deaeration line (J) to at least 10 mm above the maximum tank level.
- Insert the overflow line (H) and deaeration line (J) downwards into the dosing tank or collection container. Avoid loops.

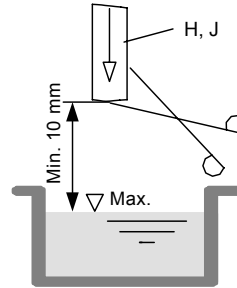


Fig. 23 Overflow and deaeration lines

Dosing medium can leak from the overflow and deaeration lines. Route both lines into a collection container or the tank!

Caution

Do not immerse the overflow line and deaeration line in the dosing medium!

Caution

Observe the pressure limits specified in section 1. General information!

6. Electrical connections

Make sure that the pump is suitable for the electricity supply on which it will be used.



Warning
Electrical connections must only be carried out by qualified personnel!
Disconnect the power supply before connecting the power supply cable and the relay contacts!
Observe the local safety regulations!



Warning
The pump housing must only be opened by personnel authorised by Grundfos Alldos!



Warning
Protect the cable connections and plugs against corrosion and humidity.
Only remove the protective caps from the sockets that are being used.

Caution

The power supply must be electrically isolated from the signal inputs and outputs.

6.1 Connecting the signal lines for DDI 209

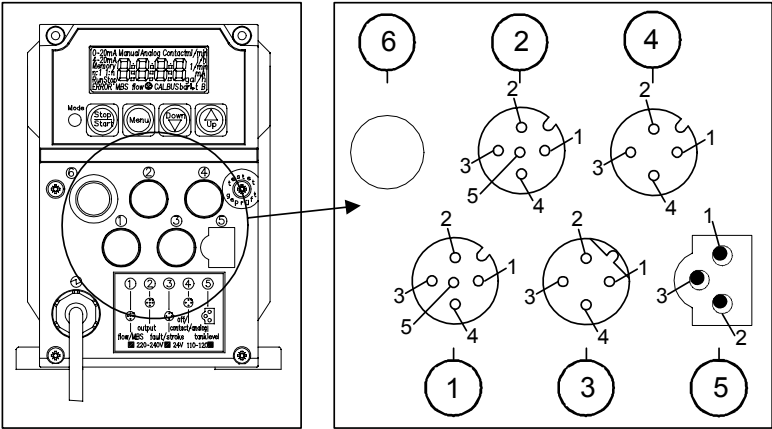


Fig. 24 DDI 209 connection diagram

6.1.1 Diaphragm leakage signal

Socket 1

For diaphragm leakage signal (MLS).
The diaphragm leakage signal is pre-assembled with an M12 plug for socket 1.

- Connect the cables according to the table below.

Socket 1		Used for / wire colours	
		Diaphragm leakage signal (MLS)*	
Pin	Assignment	Cable 0.8 m	Cable 3 m (without plug)
1	+ 12 V		
2	MLS / GND	White	White
3	MLS supply	Blue	Yellow
5	MLS output	Green/yellow	Green

* MLS is an abbreviation of the function in German language "Membranleckagesignalisierung" = diaphragm leakage signalling

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6.1.2 Current output / Flow Monitor

Socket 2

For pressure sensor for Flow Monitor option.

The pressure sensor is supplied ready-made with M12 plug for socket 2.

The current output indicates the current dosing flow and can be weighted independently of the selected operating mode. See section [9.6.4 Weighting of current input/output](#).

Socket 2		Cable	Used for	
Pin	Assignment	Wire colour	+/- current output	Flow Monitor
1	+ 5 V	Brown		Brown
3	Pressure sensor input	Blue		Blue
4	Current output	Black	+	
5	GND	Green/yellow	–	Grey

Pressure sensor (Flow Monitor):
If socket 2 is also used for current output, the plug set (product number 96645265) has to be applied as described in section [6.1.6 Accessories: cable and plug for DDI 209](#).

Note

6.1.3 Stroke/pulse signal / pre-empty signal / error signal

Socket 3

Electrically isolated output for stroke/pulse signal or pre-empty signal and error signal.

Socket 3		Cable	Used for	
Pin	Assignment	Wire colour	Stroke/pulse signal / pre-empty signal	Error signal
1	Error signal contact	Brown		x
2	Stroke/pulse signal or pre-empty signal contact	White	x	
3	Stroke/pulse signal or pre-empty signal contact	Blue	x	
4	Error signal contact	Black		x

6.1.4 Remote on/off / contact input / current input

Socket 4

For the remote on/off input and contact input or current input.

If the remote on/off and contact inputs are to be used at the same time, wire 1 is assigned twice.

Caution

For the connection of one cable, use a plug adapter with simple cable entry, for the connection of two cables, use a plug adapter with double cable entry, otherwise the protection will be lost!

Socket 4		Cable	Used for		
Pin	Assignment	Wire colour	Remote on/off input	Contact input	+/- current input
1	GND	Brown	x	x	–
2	Current input	White			+
3	Remote on/off input	Blue	x		
4	Contact input	Black		x	

6.1.5 Empty signal only / pre-empty and empty signal

Socket 5

For the empty signal only or pre-empty and empty signal input.

The suction lines with empty signal or pre-empty and empty signal are pre-assembled with a plug for socket 5.

Socket 5		Used for	
Pin	Assignment	Empty signal	Pre-empty signal
1	Empty signal	x	
2	GND	x	x
3	Pre-empty signal		x

6.1.6 Accessories: cable and plug for DDI 209

Description	Product numbers
4-pole M12 plug, suitable for socket 3, with 2 m signal cable	96609017 / 321-206
4-pole M12 plug, suitable for socket 3, with 5 m signal cable	96609019 / 321-208
4-pole M12 plug, suitable for socket 4, with 2 m signal cable	96609014 / 321-205
4-pole M12 plug, suitable for socket 4, with 5 m signal cable	96609016 / 321-207
5-pole M12 plug set, suitable for socket 2, with coupling for pressure sensor (Flow Monitor) and 2 m of signal cable for the current output	96645265 / 321-327
5-pole M12 plug, suitable for sockets 1, 2 and 4, screwed, without cable, with double cable entry	96609030 / 321-210
5-pole M12 plug, suitable for sockets 1, 2 and 4, screwed, without cable, with single cable entry	96609031 / 321-217
Extension cable, 5 m with 5-pole coupling for M12 plug	96609032 / 321-223

6.2 Connecting the power supply cable



Warning

Disconnect the power supply before connecting the power supply cable!

Before connecting the power supply cable, check that the rated voltage stated on the pump nameplate corresponds to the local conditions!

Do not make any changes to the power supply cable or plug!

Caution

The pump can be automatically started by connecting the power supply!

Caution

The assignment between the plug-and-socket connection and the pump must be labelled clearly (e.g. by labelling the socket outlet).

- Do not switch on the power supply until you are ready to start the pump.

6.2.1 Versions without mains plug



Warning

The pump must be connected to an external clearly labelled mains switch with a minimum contact gap of 3 mm in all poles.

- Connect the pump to the mains in accordance with local electrical installation regulations.

Pump in 24 V version

- Connect the power supply cable according to the table below:

Assignment	Wire colour
	Brown
	Blue
	Green/yellow



Warning

IP65 can only be ensured if the power supply cable is connected with IP65 protection.

6.2.2 Version with mains plug

- Insert the mains plug in the mains socket.

7. Start-up / shutdown



Warning

Risk of chemical burns!

Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Before each start-up, check the dosing head screws.

After initial start-up and after each time the diaphragm is changed, tighten the dosing head screws.

Caution

After approximately 6-10 operating hours or two days, cross-tighten the dosing head screws using a torque wrench.

Maximum torque:

DDI 0.4 - DDI 5.5: 2.1 Nm.

DDI 13.8 - DDI 20: 2.5 Nm.

7.1 Initial start-up / subsequent start-up

7.1.1 Checks before start-up

- Check that the rated voltage stated on the pump nameplate corresponds to the local conditions!
- Check that all connections are secure and tighten, if necessary.
- Check that the dosing head screws are tightened with the specified torque and tighten, if necessary.
- Check that all electrical connections are correct.

With Plus³ system

- Open the isolating valve (D) at the calibration tube.

7.1.2 Assisting suction for Plus³ system

Pumps with Plus³ system have an assisting suction.

- Fit the syringe and the piece of hose.

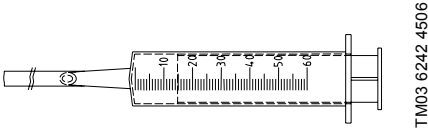


Fig. 25 Assisting suction for Plus³ system



Warning

Ensure that the pump is stopped!

Sucking in dosing medium using the assisting suction for Plus³ system

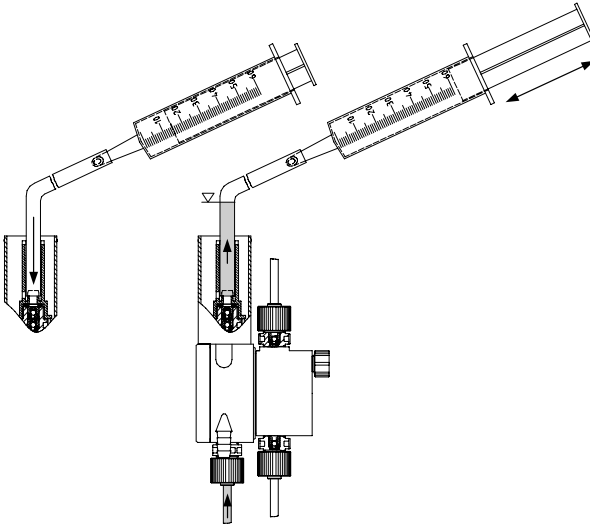


Fig. 26 Sucking in the dosing medium

1. Remove the cover from the priming chamber.
2. Push the hose as far as it will go into the valve tube.
3. Draw up the syringe in order to create a perceptible low pressure, and hold the syringe in this position.
4. Dosing medium rises in the suction line, through the valve tube to the suction hose.
5. Relieve the syringe.
6. Remove the syringe and hose and empty.
7. Close the cover.
 - For HV-variant pumps, see section [7.1.3 Assisting suction for HV variant](#).
 - Pump without HV variant can now be started, see section [7.1.5 Starting the pump](#).

7.1.3 Assisting suction for HV variant

HV-variant pumps have an assisting suction.

- Fit the syringe and the piece of hose.

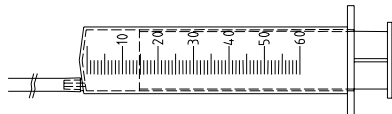


Fig. 27 Assisting suction for HV variant



Warning

Ensure that the pump is stopped!

Sucking in dosing medium using the assisting suction

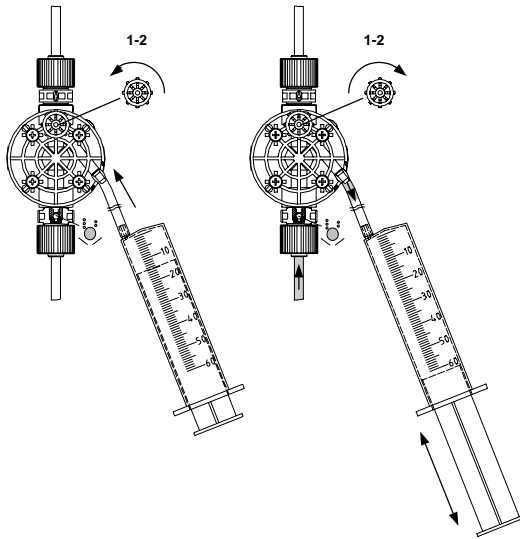


Fig. 28 Sucking in the dosing medium

1. Attach the hose to the connection for the deaeration line.
2. Open the deaeration screw, 1 or 2 turns.
3. Draw up the syringe in order to create a perceptible low pressure, and hold the syringe in this position.
4. Dosing medium rises in the suction line, up to the suction hose.
5. Relieve the syringe.
6. Carefully remove the syringe with the suction hose.
7. Empty the syringe into the dosing tank.
8. Tighten the deaeration screw.
9. Attach the deaeration line to the connection for the deaeration line. Observe the instructions in section [5.6.4 Connecting the overflow and deaeration lines](#).
 - The pump can now be started, see section [7.1.5 Starting the pump](#).

7.1.4 Assisting suction for systems without Plus³ system

At the dry suction/discharge valves:

1. Remove the suction line.
2. Hold a small container of water directly next to the suction valve and draw water until the dosing head is full.
3. Reinsert the suction line.

7.1.5 Starting the pump

1. Open the suction and discharge isolating valves, if installed.
2. Open the deaeration valve of the dosing head by approximately 1 turn.
3. Let the pump run in continuous operation:
 - Switch on the power supply.
 - Press the "Start/Stop" button and keep it pressed.
 - The pump switches to continuous operation at maximum stroke frequency.
4. Leave the pump running until the dosed medium is free of air bubbles and, for the Plus³ system, until the calibration tube is full.
 - Leave the pump DDI 0.4-10 running in continuous operation for approximately 5 min.
5. Carefully close the deaeration valve.
 - The pump is now ready for operation.

7.1.6 After initial start-up of pumps with Plus³ system

- After initial start-up, remove the adhesive label (M) from the cover (L), see figs 3 and 29.



Fig. 29 Adhesive label

7.1.7 Tightening dosing head screws

After initial start-up and after each time the diaphragm is changed, tighten the dosing head screws.

After approximately 6-10 operating hours or two days, cross-tighten the dosing head screws using a torque wrench.

Caution

Maximum torque:
DDI 0.4 - DDI 5.5: 2.1 Nm.
DDI 13.8 - DDI 20: 2.5 Nm.

7.2 Operating the pump

To operate the pump, see sections 8. Operation and 10. Maintenance and, if necessary, section 11. Fault finding chart.

Note

7.3 Shutdown

Warning

Risk of chemical burns!



Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Do not allow any chemicals to leak from the pump. Collect and dispose of all chemicals correctly!

If possible, rinse the dosing head before shutting down the pump, e.g. by supplying it with water.

Note

7.3.1 Switching off / uninstalling

1. Switch off the pump and disconnect it from the power supply.
2. Depressurise the system.
3. Take suitable steps to ensure that the returning dosing medium is safely collected.
4. Carefully remove all lines.
5. Uninstall the pump.

7.3.2 Cleaning

1. Rinse all parts that have come into contact with the medium very carefully:
 - lines
 - valves
 - dosing head
 - diaphragm.
2. Remove any trace of chemicals from the pump housing.

7.3.3 Storage

Storage of the pump:

1. After cleaning (see above), carefully dry all parts and reinstall the dosing head and valves, or
2. change the valves and diaphragm.

See section 10. Maintenance.

7.3.4 Disposal

Disposal of the pump:

- After cleaning (see above), dispose of the pump in accordance with the relevant regulations.

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8. Operation

In the event of a diaphragm leakage, the dosing liquid may leak out of the hole in the intermediate flange between the pump and the dosing head. The parts inside the housing are protected from the dosing liquid for a short time (depending on the type of liquid) by the housing sealing. It is necessary to check regularly (daily) if liquid is leaking out of the intermediate flange.

For maximum safety, we recommend the pump version with diaphragm leakage detection.

Caution

8.1 Control and display elements

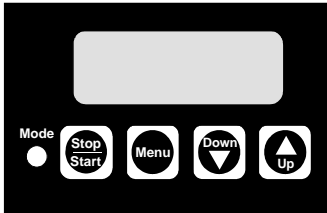







Fig. 30 Display of DDI 209

Element	Description
	<p>Light-emitting diode (LED)</p> <ul style="list-style-type: none"> Lights up red when the pump is stopped. Lights up green when the pump is started and briefly goes out during a suction stroke. Lights up yellow when the pump is switched off remotely. Flashes red if an error signal is present. Goes out when the pump is in menu mode.
	<p>"Start/Stop"</p> <ul style="list-style-type: none"> Use this button to start or stop the pump. Error signals can be acknowledged by pressing the "Start/Stop" button.
	<p>Use the "Menu/Info" button to switch between the operating modes.</p>
 	<p>Use the "Down" and "Up" buttons to change values in the display.</p>

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8.1.1 Display test

A display test is automatically performed when the pump is switched on. All the segments of the LCD are switched on for 3 seconds and the software version number is then displayed for 2 seconds.

8.2 Switching on/off

Before switching on the pump, check that it is installed correctly. See sections 5. Installation and 7.1 Initial start-up / subsequent start-up.

Caution

- To start the pump, switch on the power supply.
- To stop the pump, switch off the power supply.

8.3 Checking the dosing flow with Plus³ system

For pumps with Plus³ system, the current dosing flow can be checked during operation.

Warning

Do not let the calibration tube (E) run empty!

Re-open the isolating valve (D) in due time!

1. Close the isolating valve (D) at the calibration tube (E).
2. The supply from the priming chamber (F) is shut off and the calibration tube (E) is slowly emptied.
3. Using a stop watch, measure the time (t in seconds) it takes to dose 3 or 10 ml of dosing medium, depending on pump type.
4. Re-open the isolating valve (D) at the calibration tube (E).
5. Calculate the dosing flow:

$$V = \frac{3 \text{ ml}}{t} = \frac{10,8}{t} \left[\frac{l}{h} \right] \quad V = \frac{10 \text{ ml}}{t} = \frac{36}{t} \left[\frac{l}{h} \right]$$

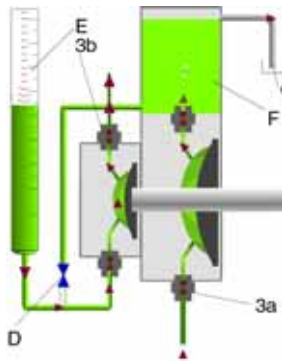
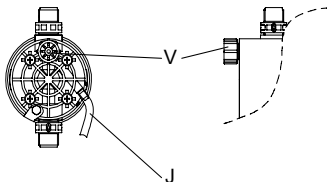


Fig. 31 Calculation of the dosing flow

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8.4 Deaeration



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Fig. 32 Manual deaeration of the dosing head (while the pump is running)

1. Open the deaeration valve (V) of the dosing head by approximately 1 turn (2 turns with Plus³ system).
2. Press the "Start/Stop" button and keep it pressed.
– The pump switches to continuous operation.
3. Leave the pump running until the medium flowing from the deaeration line (J) is free of air bubbles.
4. Carefully close the deaeration valve.

8.5 Changing the tank with Plus³ system

For pumps with Plus³ system, the tank can also be changed during operation by using the supply of dosing medium in the priming chamber.

Warning



The dosing medium is constantly supplied from the overflow line while the pump is running. Take suitable steps to ensure that the dosing medium is safely collected!

Warning



Risk of chemical burns!

Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Caution

Do not let the calibration tube (E) run empty!

Changing the tank

1. Remove the suction line, overflow line and deaeration line from the empty tank.
– The dosing medium is then supplied from the tank (F).
2. Insert the suction line, overflow line and deaeration line into the new tank.
3. Do **not** immerse the overflow line and deaeration line in the dosing medium. Route the lines downwards and without loops.

There is only a limited amount of time available to change the tank, depending on the pump type and dosing flow, e.g. 30 seconds at a dosing flow of 6 l/h!

Note

If air has been sucked in, briefly increase the stroke setting to 100 % and switch the pump to continuous operation.

9. How to use the control unit

First see sections 5. Installation, 7. Start-up / shutdown and 7.2 Operating the pump.

Note

Only the additional functions are described in this section.

9.1 Menu levels

Menu levels used in the control unit

- **First function level:** for selecting and setting the operating modes of the pump (Manual, Contact, Analog), performing the batch and timer functions and starting the pump.
- **Second function level:** for setting and viewing additional functions, selecting and setting the batch and timer functions and setting the access code to protect the pump against unintentional or unauthorised access to pump settings.
- **Service level:** for setting the pump type and the unit of display for the dosing flow (l/h or gal/h) and setting the inputs and outputs.

Saving user settings

The pump settings are automatically saved approximately every 10 minutes and remain as they are even after the power supply has been switched off.

9.2 General functions of the control unit

9.2.1 Deaeration and suction

If the "Start/Stop" button is pressed for longer than 1 second, the pump switches to continuous operation for as long as the button is held down (e.g. for suction or deaeration).

This happens regardless of the selected operating mode. (In batch or timer mode, the pump has to be stopped first.)

9.2.2 Locking "run"

The pump can be locked to avoid manual stopping. When activating this function (service level), the pump starts running with the present settings and cannot be stopped using the "Start/Stop" button.

It is still possible to acknowledge error messages using the "Start/Stop" button.

Stopping the pump when the locking "run" is activated

- If remote on/off is connected, use remote off.
- Disconnect the pump from the power supply.

Note

For "Batch manual", the "Run" button should not be locked as the pump then runs in continuous operation.

9.2.3 Two-stage tank-empty signal

This function is used to provide a warning when the tank is almost empty and to switch off the pump when the tank is empty. To use the pre-empty signal, ensure that the suction line is equipped with two float switches.

Pre-empty signal

The pre-empty signal can be an error signal or a pre-empty signal at socket 3. For a pre-empty signal, relay 1 must be set to "Pre-empty signal". See sections [6.1 Connecting the signal lines for DDI 209](#) and [9.7.1 Modifying the switch assignment](#).

When the contact of the corresponding float switch closes,

- the error signal relay or pre-empty signal relay switches on, but the pump is not switched off.
- The LED flashes red.
- The empty-signal symbol flashes in the display.

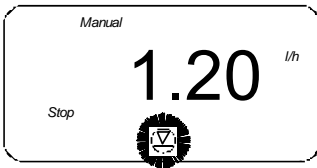


Fig. 33 Display: pre-empty signal

Once the error has been corrected,

- the error signal relay or pre-empty relay switches off.
- The pump returns to the state it was in before the error occurred.

Empty signal

When the contact of the corresponding float switch closes,

- the pump is switched off.
- The error signal relay switches on.
- The LED flashes red.
- The empty-signal symbol lights up in the display.

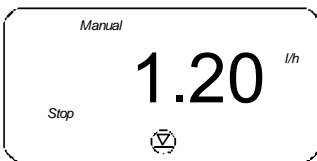


Fig. 34 Display: empty-signal symbol

Once the error has been corrected,

- the pump starts running again (if it was running before).
- The error signal relay switches off.
- The pump returns to the state it was in before the error occurred.

9.2.4 Diaphragm leakage sensor (MLS)

As an option, the pump can be equipped with a sensor for diaphragm leakage detection.

The electronics automatically detects whether a sensor is connected. The following appears in the display.

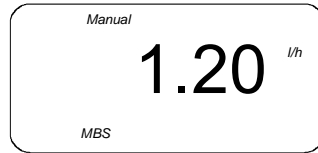


Fig. 35 Display: MLS sensor is connected

When a diaphragm leakage is detected by the sensor,

- the pump is switched off.
- The error signal relay switches on.
- The LED flashes red.
- "MBS" (MLS) and "ERROR" flash in the display.

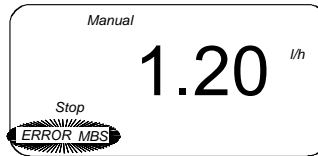


Fig. 36 Display: diaphragm leakage detected

Once the error has been corrected (the contact is no longer closed),

- press the "Start/Stop" button to acknowledge the error.
- The pump starts running again (if it was running before).
- The error signal relay switches off.
- The pump returns to the state it was in before the error occurred.

9.2.5 Hall sensor / motor monitoring

If the pump has existing strokes to process, the Hall sensor checks whether the drive is turning. If the drive motor is blocked, e.g. due to excess counter-pressure in the dosing system, this is detected and indicated by the integrated motor monitoring function.

- The error signal relay switches on.
- "1/min", "bar" and "ERROR" flash in the display.

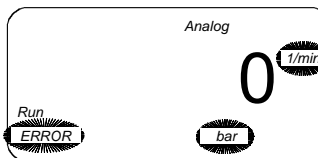


Fig. 37 Display: motor monitoring

- The pump is stopped.
- The red LED flashes.

For possible errors and their correction, see section [11. Fault finding chart](#).

Once the error has been corrected,

- press the "Start/Stop" button to acknowledge the error.

9.2.6 Remote on/off

The pump can be switched off remotely (e.g. from a control room).

- If switched off remotely, the pump does not respond to any input signals or to operator input.
Exception: The pump can still be stopped and deaerated manually.

- "Stop" lights up in the display.
- The yellow LED lights up.
- When switched on remotely, the pump returns to the state it was in before it was switched off. If, for example, the pump was previously in "Stop" mode, it returns to this mode once it is switched on.

9.2.7 Memory function

Contact signals, which cannot be processed immediately, can be stored and subsequently made available to the pump for processing. A maximum of 65,000 contact signals can be stored.

- **Without memory:** If the pump is running when a contact signal is received, the signal is ignored. The pump performs the current dosing, then it is again ready to receive new contact signals, i.e. it rejects excess contacts.
- **With memory:** If the pump is running when a contact signal is received, the signal is stored in the memory. First, the pump performs the current dosing, then it processes the contact signals from the memory.

The contents of the memory are deleted:

- by switching off the power supply
- by switching the operating mode.

The contents of the memory are not deleted:

- by actuating the remote on/off contact
- by pressing the "Start/Stop" button
- by continuous operation.

Note

The memory function can be enabled and disabled in the second function level.

9.2.8 Flow Monitor

The pump can be equipped with a pressure sensor (Flow Monitor pump option).

Based on the pressure measured by the sensor and on the motor position, an indicator diagram is created. Possible dosing faults or the exceeding of the permissible counter-pressure are detected reliably and indicated by the display or the error message output.

The following errors are recognised:

- Pressure exceeded (the pump is stopped and restarts automatically when the pressure decreases).
- Dosing error (the pump doses 30 % to 100 % less due to a leaking discharge valve or suction valve, a clogged suction line or an air bubble in the dosing head).

Caution

Depending on the operating conditions, it may be impossible to detect dosing errors which are caused by leaking suction valves!

The dosing controller and dosing control functions can be switched on and off independently of each other. It is always possible to display the pressure that has been measured during operation whenever the pressure sensor is connected.

Note

For information about operating the pump with the Flow Monitor, see section 9.10 Flow Monitor.

9.3 Signal outputs

The control unit has the following signal outputs, e.g. in order to return a signal to the control room.

9.3.1 Current signal output

Note

To use the control signal output, see section 9.9 Current signal control 0-20 mA / 4-20 mA.

The current flow rate of the pump is output as a current signal.

- Current output 0-20 mA in the following mode:
 - Current control 0-20 mA.
- Current output 4-20 mA in the following modes:
 - Current control 4-20 mA
 - Manual
 - Contact
 - Batch dosing with manual/contact start
 - Timer with manual/contact start.

Note

The current output is linear between 4 (0) mA at flow rate = 0 and 20 mA at maximum flow rate Q_{max} . (default setting) or the corresponding weighting value pair.

9.3.2 Error signal

Used to return various error states to the control room.

9.3.3 Stroke signal / pre-empty signal / pulse input

Depending on the relay setting, the contact output receives a signal in these cases:

- for each complete stroke of the pump, or
- a pre-empty signal input, or
- each pulse input at the pump.

To set the relay, see section 9.7.1 *Modifying the switch assignment*.

9.4 First function level

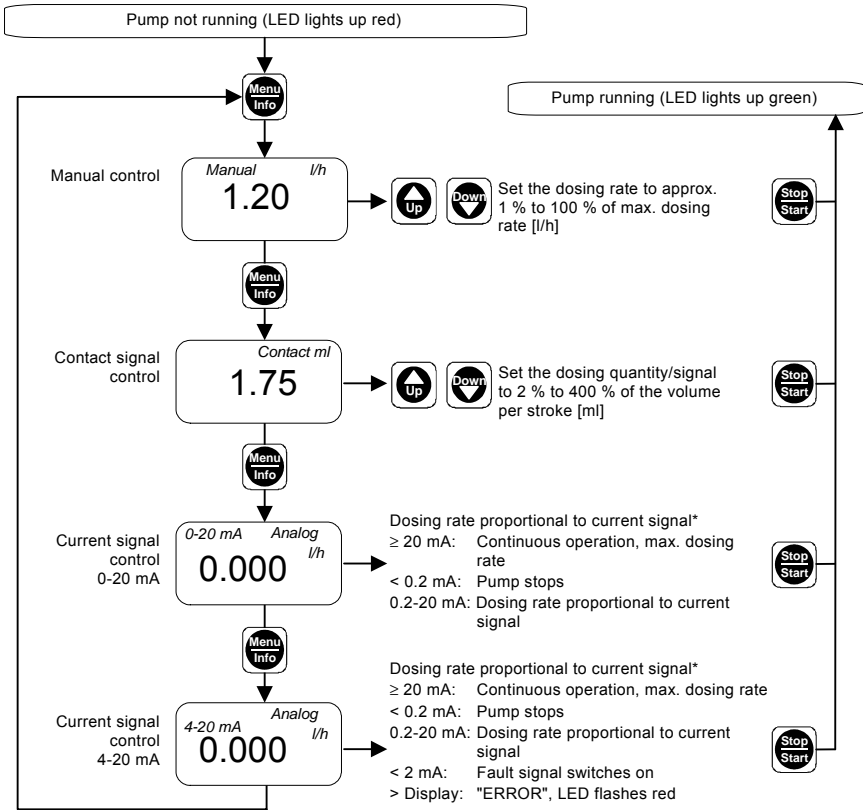


Fig. 38 First function level

* You can modify the assignment between the current input and the flow rate. See section [9.9 Current signal control 0-20 mA / 4-20 mA](#).

9.4.1 Setting the operating modes

The operating modes are selected in the first function level, and settings can be made for the modes.

This function level can only be opened when the pump is stopped.

1. When the pump is stopped (LED lights up red), press the "Menu/Info" button.
– The first function level is opened.
2. Navigate in the first function level by repeatedly pressing the "Menu/Info" button.
3. Use the "Up" and "Down" buttons to modify the settings in the relevant menu as shown in fig. 38.
4. Press the "Start/Stop" button to confirm the settings and to exit the first function level.
– The pump is running (LED lights up green).

9.4.2 Manual control

Dosing with manual on/off and manually adjustable dosing flow

In this operating mode, all the settings are entered on the pump by the operator.

- Use the "Start/Stop" button to start or stop the pump.
- Use the "Up" and "Down" buttons to increase or decrease the flow rate. This can be done when the pump is stopped or when it is running.

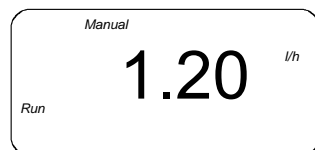


Fig. 39 Display: manual control

The maximum displayed/adjustable flow rate is automatically set according to the selected pump type and the calibrated stroke volume.

Input range for the flow rate

Pump type	$Q_{min.}$ [l/h]	Resolution of flow rate
DDI 0.4-10	0.004*	1 ml/h
DDI 2.2-16	0.025	
DDI 2.5-10	0.025	5 ml/h for $Q < 1$ l/h 10 ml/h for $Q \geq 1$ l/h
DDI 5.5-10	0.055	
DDI 13.8-4	0.140	20 ml/h for $Q < 10$ l/h
DDI 20-3	0.200	100 ml/h for $Q \geq 10$ l/h

* For counter-pressures lower than 3 bar, $Q_{min.}$ continuously increases from 0.004 l/h to 0.006 l/h.

9.4.3 Contact signal control

Note

The pump must be started first in this operating mode (LED lights up green and "Run" appears in the display).

- Use the "Start/Stop" button to start or stop the pump.

For continuous dosing in a process

For each signal received at the contact input of the pump (e.g. from a water meter with reed contact output), the pump doses the set dosing capacity. The dosing is continuously distributed between the incoming contacts via a controller. The maximum dosing capacity must not be exceeded.

Input range for the dosing capacity per contact

Pump type	Stroke volume [ml]	Min. dosing capacity (= 1/50 stroke/contact) [ml]	Max. dosing capacity (= 4 strokes/contact) [ml]
DDI 0.4-10	0.07	0.001	0.28
DDI 2.2-16	0.22	0.004	0.86
DDI 2.5-10	0.22	0.004	0.88
DDI 5.5-10	0.55	0.011	2.20
DDI 13.8-4	1.24	0.025	4.96
DDI 20-3	1.92	0.039	7.86

Even if the pump receives more contact signals than it can process at the maximum flow rate, it only runs in continuous operation with a maximum stroke frequency of 180/min. (120/min. in slow mode).

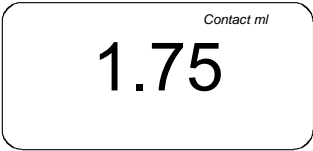


Fig. 40 Display: contact signal control

Use the "Up" and "Down" buttons in the first function level to set the dosing volume for each contact signal.

1. When the pump is stopped (LED lights up red), press the "Menu/Info" button.
 - The first function level is opened.
2. Use the "Up" and "Down" buttons in the "contact signal control" menu to set the dosing volume per contact signal.
3. Press the "Start/Stop" button to confirm the settings and to exit the first function level.
 - The pump is running (LED lights up green).

9.4.4 Current signal control 0-20 mA / 4-20 mA

For current signal control, see section [9.9 Current signal control 0-20 mA / 4-20 mA](#).

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9.5 Second function level

9.5.1 Opening / exiting the second function level

Open the second function level

- to set the access code,
- to enable or disable functions such as Flow Monitor or memory,
- to enter settings for operating modes such as batch mode,
- to display the total number of operating hours and total dosing capacity,
- to carry out a calibration, or
- to modify the assignment between the current input/output and dosing rate.

This function level can only be opened when the pump is stopped (LED lights up red).

9.5.2 Setting the access code

The access code is used to protect the pump against unintentional/unauthorised access to pump settings.

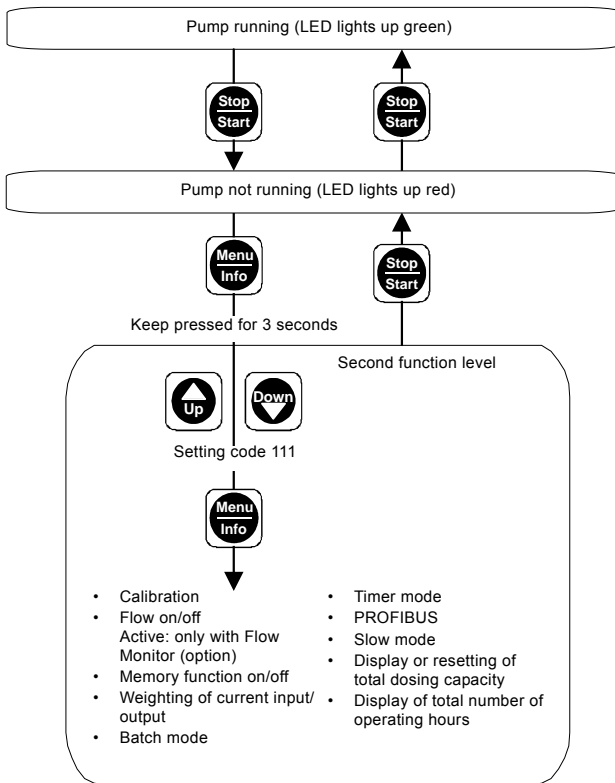
The default setting is 111. Code 111 gives access to all settings described in sections [9.4 First function level](#) and [9.5 Second function level](#).

Note

The "Start/Stop" button for stopping the pump is active with any code.

1. Press the "Start/Stop" button while the pump is running (LED lights up green).
 - The pump is stopped (LED lights up red).
2. Press and hold down the "Menu/Info" button for 3 seconds.
 - The second function level is opened.
 - The input arrow appears in the display.
 - "C:111" (default setting is "111") or a user-defined code appears in the display.
3. Use the "Up" and "Down" buttons to set the code in the range between 1 and 999.

Code 111 is required to open the second function level.



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Fig. 41 Opening / exiting the second function level

1. Navigate in the second function level by repeatedly pressing the "Menu/Info" button.
2. Use the "Up" and "Down" buttons to modify the settings in the relevant menu as shown in fig. 42.
3. Press the "Start/Stop" button to exit the second function level.

You can only change the parameters in the shown order. When the "Menu/Info" button is pressed again (after one run), the first function level opens automatically.

Note

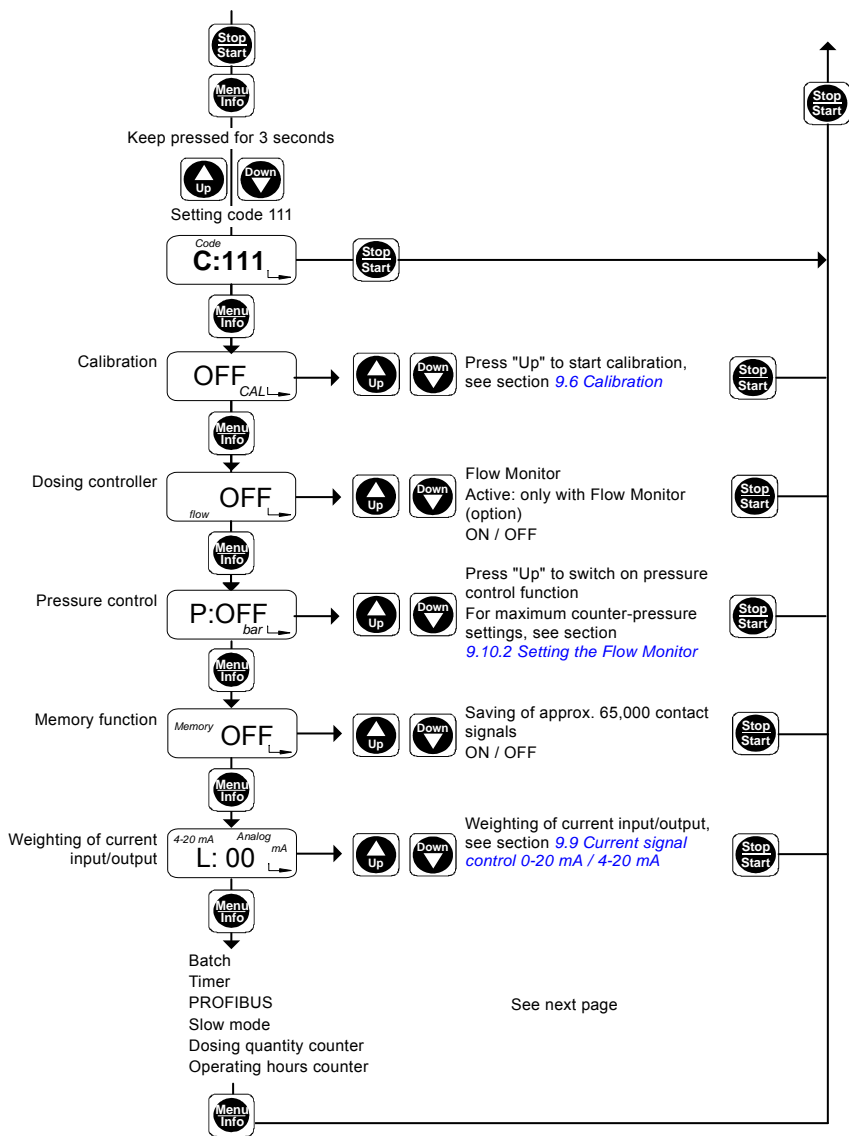


Fig. 42 Second function level, part 1

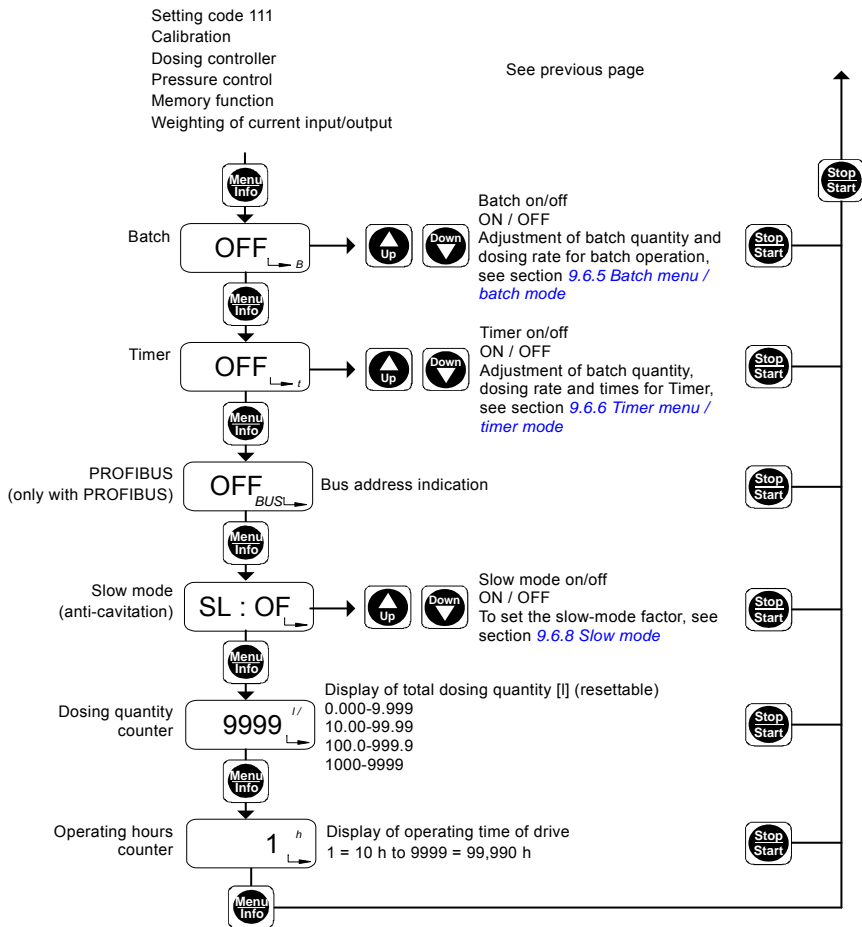


Fig. 43 Second function level, part 2

9.6 Calibration

The dosing flow display is set by default for an operating counter-pressure of 3 bar. Calibration can be used to set the pump flow to the actual operating conditions.

Calibrate the pump under normal operating conditions with the discharge line connected and at operating counter-pressure.

Due to the small stroke volume of the DDI 0.4-10, calibration is essential for a precise dosing flow.

Before calibrating the DDI 0.4-10, deaerate the pump and then let it run for 15 minutes at operating counter-pressure with full stroke rate.

The dosed volume must be gauged in litres during calibration, e.g. by drawing the dosing medium from a gauged tank. (For an alternative for pumps with Plus³ system, see section 9.6.1 Calibrating pumps with Plus³ system (internal calibration)).

Note

"OFF CAL" appears in the display.

1. Press the "Up" button.
 - "ON CAL" appears in the display.
2. Press the "Start/Stop" button.
 - Calibration is started. The LED flashes green and "Run" flashes in the display.
- 200 strokes are performed by default. The number of strokes performed appears in the display.
- Press "Start/Stop" to stop at any stroke value.
 - The LED lights up red.
3. Press the "Start/Stop" button.
 - The current calibration value is displayed (not with replacement circuit boards!).

4. Use the "Up" and "Down" buttons to enter the calibration value (gauged volume in ml).
 - Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
 - press the "Start/Stop" button (confirm the setting and close the second function level).

The calibration process does not change the setting for the assignment/weighting of the current input and output for the flow rate.

If a current input or output is used, check after calibration to determine whether a new current weighting is required.

Note

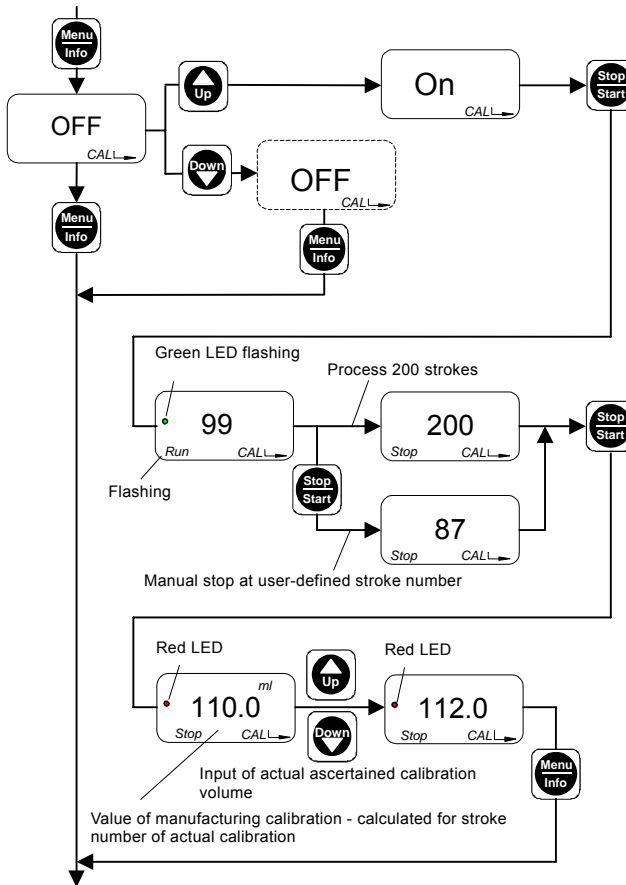


Fig. 44 Calibration

9.6.1 Calibrating pumps with Plus³ system (internal calibration)

1. Before opening the second menu level, close the isolating valve (D) on the calibration tube (E) and allow the pump to dose a couple of strokes so that the liquid level is within the scale.
2. Stop the pump.
3. Slowly open the isolating valve (D) and allow the dosing medium to rise to the top of the scale in the calibration tube. Close the isolating valve (D).
4. Open the calibration menu.
 - "OFF CAL" appears in the display.
1. Press the "Up" button.
 - "ON CAL" appears in the display.
2. Press the "Start/Stop" button.
 - Calibration is started. The LED flashes green and "Run" flashes in the display.
3. Press the "Start/Stop" button to stop the calibration when the liquid level reaches the bottom of the scale.
 - The LED lights up red.

4. Press the "Start/Stop" button.
 - The current calibration value is displayed (not with replacement circuit boards!).
5. Use the "Up" and "Down" buttons to enter the calibration value (read volume in ml).

The pump electronics automatically calculates the calibration value based on the actual strokes performed.
6. Open the isolating valve.
 - Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
 - press the "Start/Stop" button (confirm the setting and close the second function level).

Adjusting the operating counter-pressure without gauging the dosed volume during calibration

If you do not gauge the dosed volume, you can determine the "calibration value" from the following dosing capacity curves in order to adjust your pump to the operating counter-pressure.

The curves represent 200 strokes:

- Dosing medium with a viscosity similar to water
- Pumps without Plus³ system.

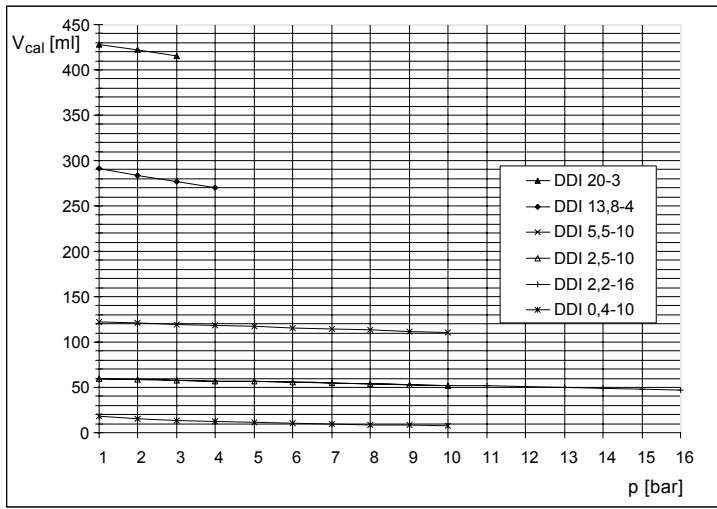


Fig. 45 Dosing capacity curves

Values are approximate values and do not take into consideration deviations due to construction tolerance according to VDMA 24284.

Note

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9.6.2 Flow Monitor

In order for the pressure sensor (if installed) to function as a dosing controller, the dosing controller must be switched on, see section [9.10 Flow Monitor](#).

9.6.3 Memory function

The memory function is used to store excess contact signals for processing later, see section [9.2.7 Memory function](#).

- Switch the memory function on/off with "Up" / "Down".
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the second function level).

9.6.4 Weighting of current input/output

In current input/output operation, the dosing capacity is controlled via the current signal. The pump emits a current signal as a feedback for control rooms or master/slave applications.

Note

For weighting of current input/output, see also 9.9 Current signal control 0-20 mA / 4-20 mA.

9.6.5 Batch menu / batch mode

In batch mode, a defined batch quantity is dosed with a defined dosing flow. See section [9.11 Batch menu / batch mode](#).

9.6.6 Timer menu / timer mode

In timer mode, a defined batch quantity is dosed with a defined dosing flow and a defined start time. See section [9.12 Timer menu / timer mode](#).

9.6.7 PROFIBUS menu

The "PROFIBUS" menu item is only displayed for pumps with PROFIBUS interfaces. The PROFIBUS interface is activated/deactivated in this menu and the bus address is specified.

9.6.8 Slow mode

Activating the slow-mode function lengthens (slows down) the suction stroke. For example, cavitation is thus reduced with viscous media.

Slow mode can be activated in any operating mode.

Note

The maximum flow rate of the pump decreases. The time for the suction stroke increases. The maximum stroke rate in slow mode is 120 1/min.

9.6.9 Display/resetting of total dosing capacity

The total capacity dosed since the value was last reset is displayed.

Note

The maximum value that can be displayed is 9999 l. If this value is exceeded, the counting starts again at zero.

To reset the value,

1. press the "Up" button.
 - "dEL" appears in the display.
2. Press the "Start/Stop" button.
 - The total dosing capacity is deleted.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the second function level).

9.6.10 Display of total number of operating hours

The operating hours counter indicates the operating time of the drive, e.g. to check maintenance intervals. The maximum number of operating hours that can be displayed is 99,990 h (display = 9999).

The operating hours counter cannot be reset.

Note

Multiply the number displayed by 10 to determine the number of operating hours.

9.7 Service level

Open the service level

- to modify the switch assignments of the control unit,
- to set the pump type, or
- to select the unit of measurement for the dosing flow (l/h or gal/h) that will be displayed.

9.7.1 Modifying the switch assignment

Note

You are modifying the default settings of your control unit. They will therefore differ from the technical data.

The service level can only be accessed when the power supply is switched on.

1. Simultaneously press the "Menu/Info" and "Down" buttons and hold them down.
2. Switch on the power supply.
 - The LED alternately flashes red and green.
3. Release the "Menu/Info" and "Down" buttons.
4. Press the "Start/Stop" button.
5. Press the "Up" button.
 - The LED lights up yellow.
 - "Func" appears in the display.
6. Press the "Menu/Info" button.
 - The service level is opened.

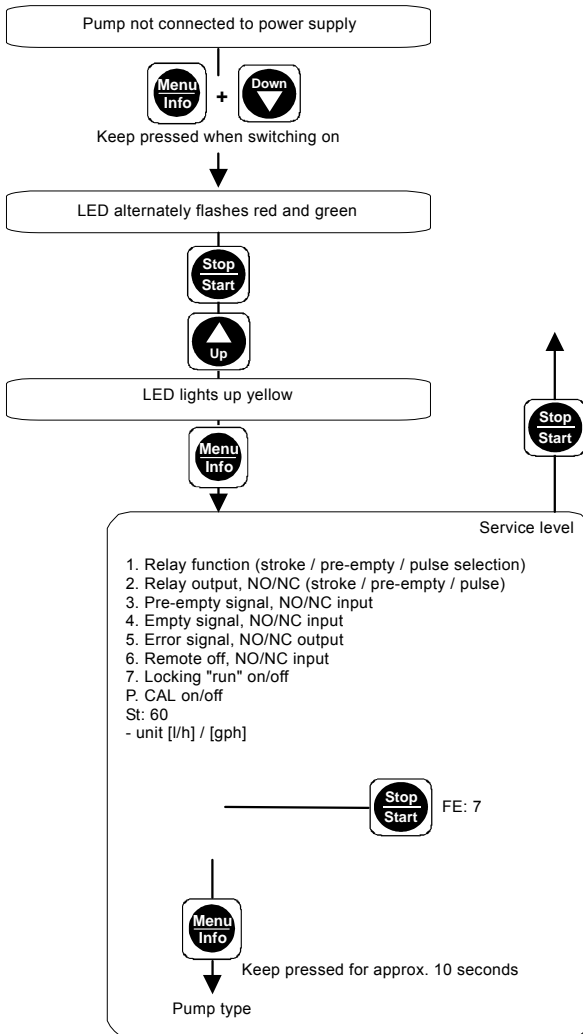


Fig. 46 Opening / exiting the service level

1. Navigate in the service level by repeatedly pressing the "Menu/Info" button.
2. Use the "Up" and "Down" buttons to modify the switch assignment in the relevant menu.
3. Press the "Menu/Info" button for 10 seconds to open the pump type selection.
4. Press the "Start/Stop" button
 - to confirm the new settings
 - to exit the service level
 - to open the first function level.

1. Relay function (stroke / pre-empty / pulse selection)

"1:OFF", "1:ON" or "1:1:1" appears in the display.

- Use the "Up" and "Down" buttons to switch between:
 - "1:OFF": Relay function = stroke signal ("1/min" flashes in the display), and
 - "1:ON": Relay function = pre-empty signal (empty-signal symbol flashes in the display), and
 - "1:1:1": Relay function = pulse input ("n:1" flashes in the display).
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

2. Relay output, NO/NC (stroke / pre-empty / pulse)

"2:NO" or "2:NC" appears in the display ("1/min" and empty-signal symbol flash in the display).

- Use the "Up" and "Down" buttons to switch between:
 - "2:NO": Stroke/pre-empty signal/pulse input relay = normally open contact, and
 - "2:NC": Stroke/pre-empty signal/pulse input relay = normally closed contact.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

3. Pre-empty signal, NO/NC input

"3:NO" or "3:NC" appears in the display (empty-signal symbol flashes in the display).

- Use the "Up" and "Down" buttons to switch between:
 - "3:NO": Pre-empty signal = normally open contact, and
 - "3:NC": Pre-empty signal = normally closed contact.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

4. Empty signal, NO/NC input

"4:NO" or "4:NC" appears in the display (empty-signal symbol lights up in the display).

- Use the "Up" and "Down" buttons to switch between:
 - "4:NO": Empty signal = normally open contact, and
 - "4:NC": Empty signal = normally closed contact.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

5. Error signal, NO/NC output

"5:NO" or "5:NC" appears in the display ("ERROR" flashes in the display).

- Use the "Up" and "Down" buttons to switch between:
 - "5:NO": Error signal relay = normally open contact, and
 - "5:NC": Error signal relay = normally closed contact.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

6. Remote off, NO/NC input

"6:NO" or "6:NC" appears in the display ("Run" and "Stop" flash in the display).

- Use the "Up" and "Down" buttons to switch between:
 - "6:NO": Remote off = normally open contact, and
 - "6:NC": Remote off = normally closed contact.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

7. Locking "run" on/off

The locking of the "Start/Stop" button to prevent manual stopping of the pump can be enabled and disabled.

The display indicates "7:ON" or "7:OFF" (the "Run" symbol is displayed).

- Use the "Up" and "Down" buttons to switch between:
 - "7:ON": Locking "run" on, and
 - "7:OFF": Locking "run" off.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the service level).

P: CAL on/off (only for Flow Monitor)

"CAL:ON" or "CAL:OFF" appears in the display ("CAL" appears).

- Use the "Up" and "Down" buttons to switch between:
 - "CAL:ON": Calibration of the pressure sensor for the Flow Monitor enabled, and
 - "CAL:OFF": Calibration of the pressure sensor for the Flow Monitor disabled.

For calibration, see section

Note **9.10.7 Calibrating the sensor after the sensor has been replaced.**

St: e.g. "60" (only for Flow Monitor)

- Use the "Up" and "Down" buttons to set the "number of error strokes permitted when starting". If the number of error strokes is exceeded, the "Flow error" error message appears.

FE: e.g. "7" (only for Flow Monitor)

- Use the "Up" and "Down" buttons to set the "number of error strokes permitted during operation". If the number of error strokes is exceeded, the "Flow error" error message appears.

Selection of unit (display)

"Unit l/h" or "Unit gph" appears in the display.

- Use the "Up" and "Down" buttons to switch between:
 - "Unit l/h": Unit Q = l/h, and
 - "Unit gph": Unit Q = gal/h.
- Press the "Start/Stop" button (confirm the setting and close the service level), or
- press the "Menu/Info" button for a minimum of 10 seconds (confirm the setting and open the pump selection).

Pump selection

The actual pump type must always be selected to ensure error-free operation of the electronic control function. Otherwise the displayed pump and signals differ from the actual conditions.

Caution

"-0.4", "-2.2", "-2.5", "-5.5", "-13.8" or "-20" appears in the display.

- Use the "Up" and "Down" buttons to switch between the pump types DDI 0.4-10, DDI 2.2-16, DDI 2.5-10, DDI 5.5-10, DDI 13.8 and DDI 20-3.
- Select your pump type, which is indicated on the pump nameplate.
- Press the "Start/Stop" button and switch the power supply off, then back on again (confirm the setting and close the service level).

9.8 Resetting to default settings

You can reset the first and second function levels to the default settings while the power supply is being connected.

The service level settings (pump type, unit of display for the dosing flow, input and output settings) and the values for the total dosing capacity and operating hours counter remain as they are.

Note

The pump is disconnected from the power supply.

1. Simultaneously press the "Up" and "Down" buttons and hold them down.
2. Switch on the power supply.
 - "boot" appears in the display.
3. Release the "Up" and "Down" buttons.
 - All modified settings at the first and second function levels are reset to the default settings.

9.9 Current signal control

0-20 mA / 4-20 mA

For controlling the dosing pump via an external current signal of 0-20 mA (4-20 mA)

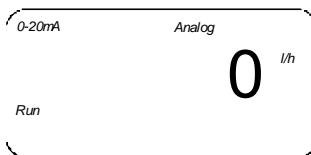


Fig. 47 Display: 0-20 mA current signal control

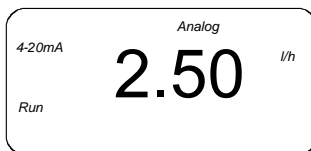


Fig. 48 Display: 4-20 mA current signal control

- The flow rate is proportional to a current input signal of 0-20 mA (4-20 mA).
- Above 19.5 mA, the pump runs in continuous operation at maximum dosing flow (Q_{max}).
- Below 0.2 (4.2) mA, the pump switches off.

Default setting for Q_{max} is the dosing flow up to 3 bar (default calibration value). Once the pump has been calibrated, the current signals must be weighted. See sections 9.9.2 With calibrated pump and 9.9.3 Setting the weighting.

Note

The pump must be started first in this operating mode (LED lights up green and "Run" appears in the display).

- Use the "Start/Stop" button to start or stop the pump.

4-20 mA current signal control

If the current input signal falls below 2 mA, the error relay is switched, as an error has probably occurred at the signal source or on the cable.

- The error signal relay switches on. The LED flashes red.
- "4-20 mA" and "ERROR" flash in the display.



Fig. 49 Display: 4-20 mA current signal control

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The assignment between the current signal and flow rate is linear.

- With 0-20 mA current signal control, the curve for current input and current output passes through $Q = 0$ at 0 mA and the value pair $Q_{\max.} (Q_{\text{cal}})$ at 20 mA (curve 1a).
- With 4-20 mA current signal control, the curve for current input and current output passes through $Q = 0$ at 4 mA and the value pair $Q_{\max.} (Q_{\text{cal}})$ at 20 mA (curve 2a).
- With manual or contact control, the curve for current output passes through $Q = 0$ at 4 mA and the value pair $Q_{\max.} (Q_{\text{cal}})$ at 20 mA (curve 2a).

The default setting for $Q_{\max.}$ is the maximum dosing flow at default calibration at 3 bar.

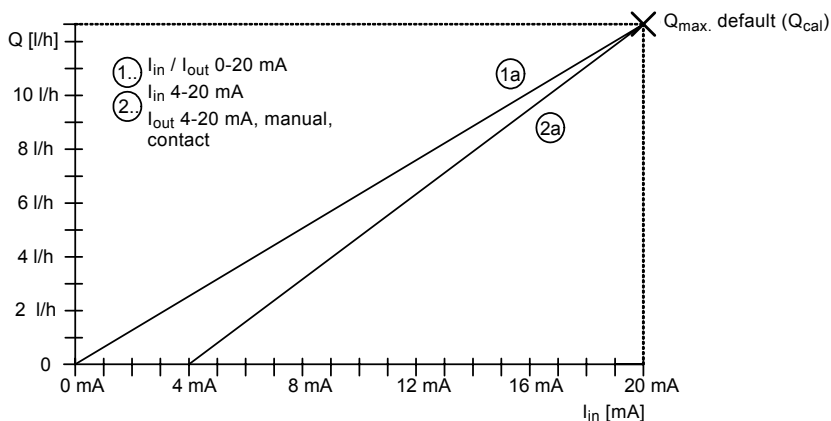


Fig. 50 Current input and current output with default setting

9.9.1 Direct weighting of the current signal input and output

Weighting while the pump is running can be carried out in the first function level. The currently set value increases or decreases for the maximum flow rate $Q_{\max.} (Q_{cal})$, or with weighting set value $Q_{select\ mA\ max.}$.

Setting the weighting

The parameters for 0-20 mA and for 4-20 mA are independent of one another. The weighting parameters are modified and saved according to the set operating mode.

Note

Select the current control used (0-20 mA / 4-20 mA) before weighting.

Weighting can be set independently of the current input value that is currently set. The dosing flow value [l/h] that corresponds to the set current input value [mA] always appears in the display.

Note

- 1. When the pump is running or stopped, press and hold down the "Up" button for approximately 5 seconds.
 - "0-20 mA" or "4-20 mA", "Analog" and "l/h" flash in the display.
- 2. Use the "Up" and "Down" buttons to increase or decrease the currently set value for the maximum flow rate.

The curve for current input/current output now passes as follows:

- With 0-20 mA (4-20 mA) current signal control, the curve for current input and current output passes linearly through $Q = 0$ at 0 mA (4 mA) and the currently set value for the maximum flow rate $Q_{select\ max.}$ at 20 mA (curves 1b and 2b).

The set weighting is saved in the pump. The values are retained, e.g. when the power supply is switched off, and are also active when current weighting is called in the second function level.

Note

Even for current input/current output assignments that are already weighted in the second function level (see curve 3a), subsequent weighting can be set or weighting can be shifted here. The value for the maximum flow rate $Q_{select\ mA\ max.}$ at $mA_{max.}$ is shifted (curve 3b).

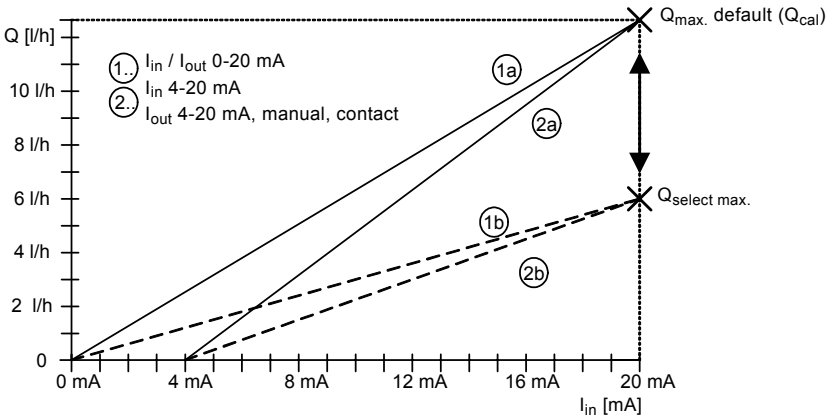


Fig. 51 Current input and current output with direct weighting

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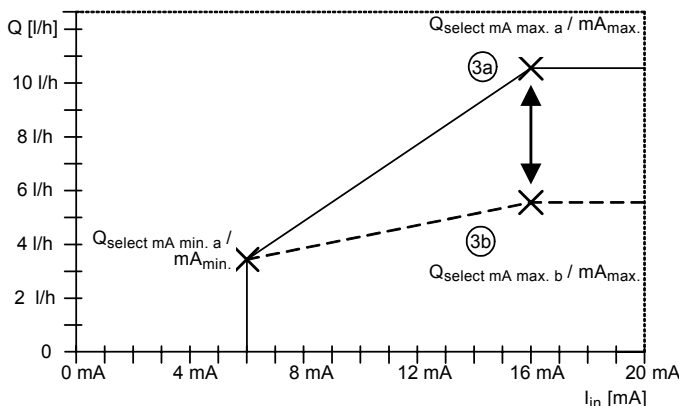


Fig. 52 Current input and current output with subsequent weighting

9.9.2 With calibrated pump

When calibrating the pump for your application and using current signal control and/or current output, proceed as follows:

1. Calibrate the pump.
2. Determine the maximum flow rate Q_{cal} by taking a reading on the pump: Q_{cal} is the maximum adjustable flow rate after calibration, e.g. in manual mode, or the displayed flow rate in continuous operation (press and hold down the "Start/Stop" button for longer than 1 second).
3. To set the current input/current output weighting, see section 9.9.3 *Setting the weighting*.

For unweighted assignment (curves 1a and 2a, see fig. 50) select the following reference points:

Note $L: mA_{min.} = 0 \text{ (4) mA} / Q_{select \text{ mA min.}} = 0 \text{ l/h}$
 $H: mA_{max.} = 20 \text{ mA} / Q_{select \text{ mA max.}} = Q_{cal}$

Q_{cal} is not updated automatically when the pump is re-calibrated. This protects the user-defined value pairs. After calibration, new weighting may be required!

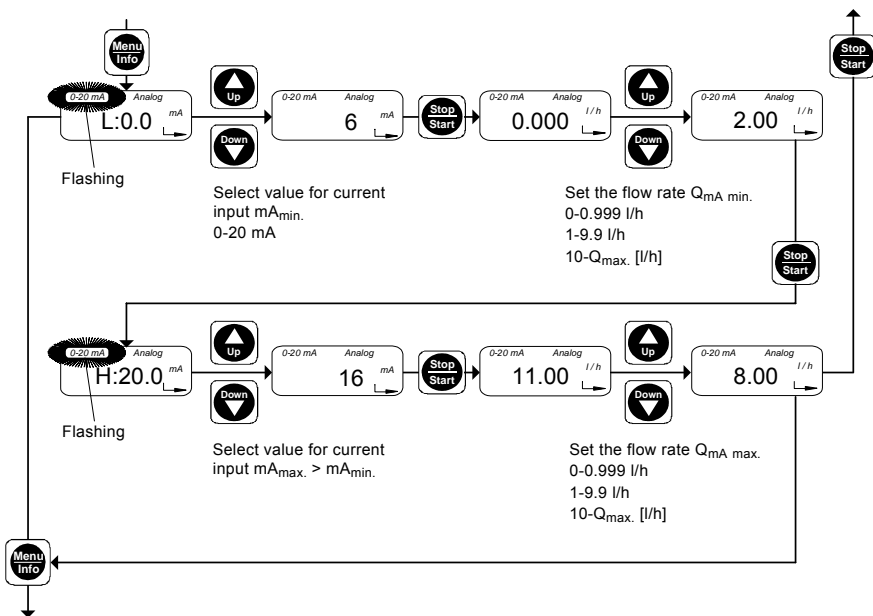
Note

9.9.3 Setting the weighting

The setting options for weighting depend on the selected current signal control. The parameters for 0-20 mA and for 4-20 mA are independent of one another. The weighting parameters are modified and saved according to the set operating mode.

Select the current control operating mode used later (0-20 mA / 4-20 mA) manually or via contact signal before weighting. (Weighting of the control output for manual control mode or contact signal control is the same as current weighting 4-20 mA.)

Note



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Fig. 53 Setting the weighting

In the second function level, first enter the values for reference pair L:

The current value for $mA_{min.}$ appears in the display (the default value is "L:0.0 mA" ("L:4.0 mA"), ("Analog" and "0-20 mA" ("4-20 mA) are flashing)).

1. Use the "Up" and "Down" buttons to enter the minimum current input $mA_{min.}$ between 0 mA (4 mA) and 20 mA (e.g. $mA_{min.} = 6$ mA).
2. Press the "Start/Stop" button.
 - The current value for the $mA_{min.}$ assigned flow rate $Q_{mA min.}$ appears in the display (the default value is 0.000).

3. Use the "Up" and "Down" buttons to enter the desired value for flow rate $Q_{mA min.}$ at $mA_{min.}$ (e.g. $Q_{mA min.} = 2$ l/h).

Now enter the values for reference pair H:

1. Press the "Start/Stop" button.
 - The current value for $mA_{max.}$ appears in the display (the default value is "H:20.0 mA").
2. Use the "Up" and "Down" buttons to enter the maximum current input $mA_{max.} > mA_{min.}$ (e.g. $mA_{max.} = 16$ mA).
3. Press the "Start/Stop" button.
 - The current value for the $mA_{max.}$ assigned flow rate $Q_{mA max.}$ appears in the display (the default value is $Q_{max.}$).

4. Use the "Up" and "Down" buttons to enter the desired value for flow rate $Q_{mA max.}$ at $mA_{max.}$ (e.g. $Q_{mA max.} = 8$ l/h).

- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the second function level).

Result of weighting

In the example, the following values were entered as reference points L_d and H_d :

L_d : $\text{mA}_{\min.} = 6 \text{ mA}$, $Q_{\text{select mA min.}} = 2 \text{ l/h}$

H_d : $\text{mA}_{\max.} = 16 \text{ mA}$, $Q_{\text{select mA max.}} = 8 \text{ l/h}$.

The curve for current input/current output now passes through $Q = 0$ at $< 6 \text{ mA}$, from $Q = 2 \text{ l/h}$ at 6 mA to $Q = 8 \text{ l/h}$ at 16 mA , and through $Q = 8 \text{ l/h}$ at $> 16 \text{ mA}$ (curve 1d).

In the same way, it is possible to enter a current weighting with a negative gradient. In order to do this, the value pair for reference point L must first be entered with the smaller mA value followed by reference point H.

In the example, the following values were entered as reference points L_e and H_e :

L_e : $\text{mA}_{\min.} = 2 \text{ mA}$, $Q_{\text{select mA min.}} = 12 \text{ l/h}$

H_e : $\text{mA}_{\max.} = 16 \text{ mA}$, $Q_{\text{select mA max.}} = 2 \text{ l/h}$.

The curve for current input/current output now passes through $Q = 0$ at $< 2 \text{ mA}$, from $Q = 12 \text{ l/h}$ at 2 mA to $Q = 2 \text{ l/h}$ at 16 mA , and through $Q = 2 \text{ l/h}$ at $> 16 \text{ mA}$ (curve 1e).

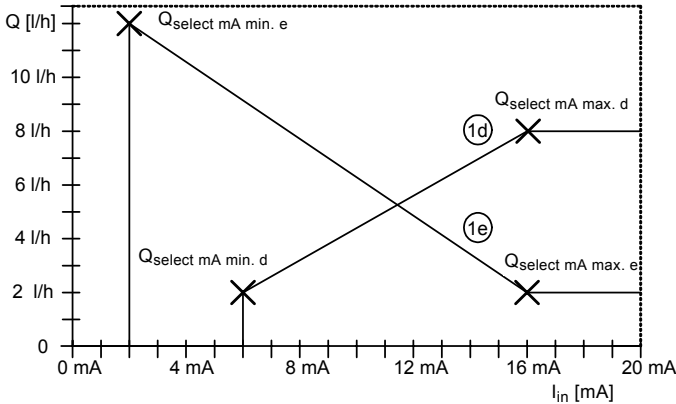


Fig. 54 Result of weighting

Note

The maximum flow rate of the pump must not be exceeded!

Note down the set current weighting in the following diagram for current input/current output:

1. Label the Q [l/h] axis for your working area.
2. Mark your reference points with the value pairs:
L: mA_{min.} / Q_{select} mA min. and
H: mA_{max.} / Q_{select} mA max. in the diagram.
3. Draw the curve as a line from L to H, vertically from Q_{select} mA min. to the mA axis, and horizontally from Q_{select} mA max. to the edge of the diagram.

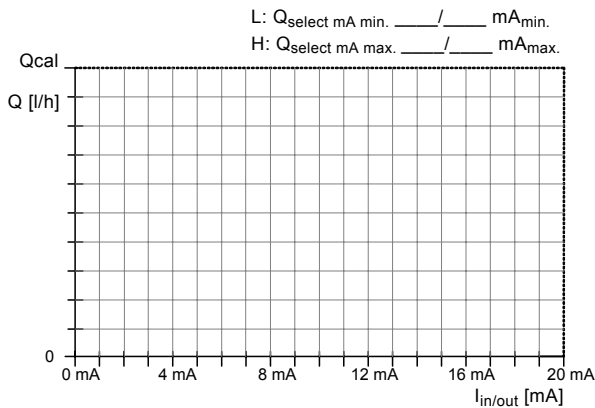


Fig. 55 Diagram for current input/current output

9.10 Flow Monitor

9.10.1 Application notes

Dosing of degassing media (H₂O₂, chlorine bleaching agents)

- For a robust operation, set the number of permissible error strokes to a value higher than 10.

Dosing of antiscalent (viscosity higher than 20 mPa s), in particular for DDI 0.4-10 with Plus³

- Use spring-loaded valves for high-viscosity media.

Dosing of viscous media

- For media with a viscosity higher than 20 mPa s, spring-loaded suction and discharge valves are recommended.
- Dosing media with a viscosity higher than 100 mPa s on request.

For batch or timer operation

- Set the number of permissible error strokes to a value lower than the number of working strokes.
- If, while the pump is stopped, the pressure in the discharge line falls below the minimum pressure of 2 bar (e.g. in the event of a leak in the pressure-loading valve), increase the number of permissible error strokes so as to prevent unnecessary error messages.

Ensuring the counter-pressure by a pressure-loading valve:

- Check the counter-pressure 2 to 3 weeks after start-up.
 - If it is below 2 bar, the pressure-loading valve has to be re-adjusted.
 - If the volume flow is not constant (as, for example, in the case of contact or analog control), even small volume flows should not fall below the minimum pressure or minimum pressure difference of 2 bar.

Set cut-off pressure

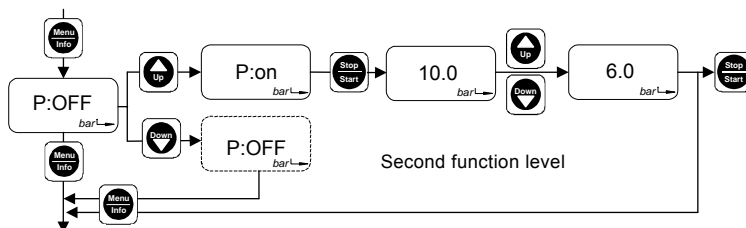


Fig. 56 Set cut-off pressure

9.10.2 Setting the Flow Monitor

In order for the pressure sensor (if installed) to function as a dosing controller, the dosing controller must be switched on.

To allow the pump to switch off in the event of overpressure and to set the cut-off pressure of the pump, the pressure control function must be switched on and set.

If no pressure sensor is connected, the pump determines the pressure from the motor current.

For applications with high requirements in terms of precision, the pressure control function must be used with a pressure sensor.

Switching on dosing controller

Menu item "flow" is open.

- "flow OFF" appears in the display.
1. Press the "Up" button.
 - "flow ON" appears in the display.
 - The dosing controller is activated.

Switching on pressure control function

This menu item only appears if the pressure sensor has already been detected once.

1. Press the "Menu/Info" button.
 - Menu item "P" is open.
 - "P:OFF" appears in the display.
2. Press the "Up" button.
 - "P:ON" appears in the display.
 - The pressure control function is activated.

"P:ON" in the display:

1. Press the "Start/Stop" button.
 - The currently defined cut-off pressure is shown in the display. The default value is the maximum counter-pressure of the pump type + 1 bar (pumps < 10 bar) or + 2 bar (pumps from 10 bar and up).
2. Use the "Up" and "Down" buttons to enter the desired cut-off pressure.
 - You can set the cut-off pressure at which the pump is to be stopped at around 2 bar up to the default value.
- Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
- press the "Start/Stop" button (confirm the setting and close the second function level).

Note

The actual cut-off pressure $p_{\text{cut-off}}$ is higher than the set pressure p_{set} : $p_{\text{cut-off}} = p_{\text{set}} + 0.5 \text{ bar}$.

When you are setting the cut-off pressure, be aware that the pressure measured in the dosing head is higher than the system pressure. It is advisable to display the measured pressure first, see section [Displaying the pressure that has been measured](#). The set cut-off pressure should be higher than the measured pressure in the dosing head.

Caution

9.10.3 Dosing controller function

The pump software monitors the dosing process and emits a pulse for each dosing stroke. For each stroke, the "flow" display is momentarily turned off.

- When switched on, the electronics detects whether the dosing controller is activated.
 - "flow" appears in the display.

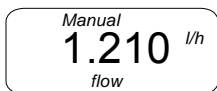


Fig. 57 Display: "Dosing controller"

Suppression of dosing control function during start-up operation

60 error strokes* are permitted during the start-up operation before an error signal is emitted. After a further 7 error strokes*, a dosing error is signalled.

* Default values, see also section [9.7.1 Modifying the switch assignment](#).

The start-up operation is triggered as follows:

- By switching on the power voltage.
- Deaeration operation (continuously pressing the "Start/Stop" button).

The start-up operation is completed

- after 60 strokes.
- after the first valid stroke signalled by the dosing controller.
- after short switching on and off the pump by pressing the "Start/Stop" button.

The number of permissible error strokes can be increased or decreased since, depending on pump type for example, 60 strokes may take a considerable time during the start-up operation.

Dosing error (after start-up operation)

If, after seven successive strokes or after the number of strokes which have been defined by the user, the dosing controller does not emit a signal, this is recognised as an error:

- The error signal relay switches on, but the pump is not switched off.
- The LED flashes red.
- "flow" and "ERROR" flash in the display.

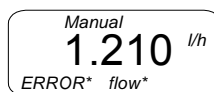


Fig. 58 Display: "Dosing error"

Once the error has been corrected and seven valid strokes have been measured or the "Start/Stop" button has been pressed, the error signal relay switches off.

- The pump returns to the state it was in before the error occurred.

9.10.4 Pressure control function

To protect the pump and system against excessive pressure build-up, install an overflow valve in the discharge line.

The pressure sensor monitors the pressure in the dosing head. If the set pressure is exceeded by 0.5 bar, the pump switches off.

When switched on, the electronics detects whether the chamber pressure control function is activated.

- "bar" appears in the display.

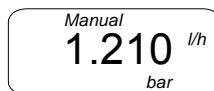


Fig. 59 Display: "Pressure control"

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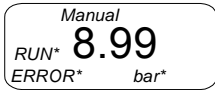
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Pressure exceeded

If, after three successive strokes, the cut-off pressure is exceeded, this is recognised as an error:

- The pump is stopped.
- The error signal relay switches on.
- The LED alternately flashes red and green.
- The last pressure value to be measured is displayed.
- "RUN", "ERROR" and "bar" flash in the display.



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Fig. 60 Display: "Pressure exceeded"

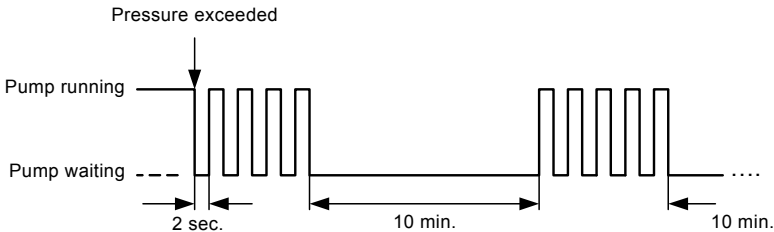


Fig. 61 Pump restart attempts

Error correction

- Press the "Start/Stop" button to stop the pump and prevent it from restarting.
- Check the discharge valve and the installation on the discharge side and correct any errors, if necessary.
For maintenance work, see section [10. Maintenance](#).
- Check and correct the pressure setting, if necessary.

Once the error has been corrected,

- press the "Start/Stop" button to restart the pump.
 - The pump returns to the state it was in before the error occurred.

Displaying the pressure that has been measured

The pressure that has been measured during the pump operation can be displayed at any time.

- Press the "Menu/Info" button twice.
(If only pressed once, the dosed quantity is displayed.)
 - The pressure is displayed for approximately 10 seconds.

Pump restart attempts:

- First the pump makes four attempts to restart, each separated by a 2-second pause, if the chamber pressure has fallen below the cut-off pressure ($p_{act} < p_{set}$).
- If, after three successive strokes, the cut-off pressure is exceeded, the pump is stopped again.
- After four attempts, the pump waits 10 minutes before attempting to automatically restart again.
- The pump continuously attempts to restart if the chamber pressure decreases in this way.

9.10.5 Error message – broken cable or faulty sensor

If the dosing controller and/or the pressure control function are/is switched on, the missing signal is recognised and emitted as an error.

A faulty pressure sensor (broken cable) is displayed as follows:

- The error signal relay switches on.
- The pump is not stopped!
- The LED flashes red.
- "ERROR" flashes in the display.

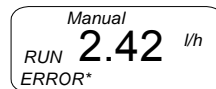


Fig. 62 Display: "Broken cable"

Correct error

- Press the "Start/Stop" button twice to confirm the error and to stop the pump.
- Repair the cable break.

TM03 6579 4506

TM03 6580 4506

Once the error has been corrected,

- press the "Start/Stop" button to restart the pump.
 - The pump returns to the state it was in before the error occurred.

If the cable is broken, the dosing controller and pressure control/pressure display functions are not active. When the "Menu/Info" button is pressed twice to display the chamber pressure, only "— — —" is displayed.

Note

If the sensor fault cannot be corrected immediately and if the pump is to continue to run without a sensor, switch off the dosing controller (flow:OFF) and pressure control function (P:OFF).

Note

9.10.6 Changing the number of permissible error strokes

To change the number of permissible error strokes during the start-up operation and during normal dosing operation.

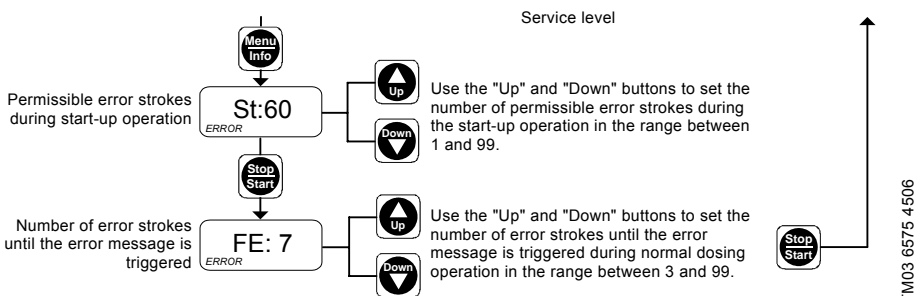


Fig. 63 Permissible error strokes

1. Open the service level.
2. Repeatedly press the "Menu/Info" button to navigate in the service level until you reach menu item "St:60" (error stroke during start-up operation).
 - The display shows "St" and the number of currently defined error strokes that are permissible during the start-up operation.
3. Use the "Up" and "Down" buttons to set the number of permissible error strokes during the start-up operation in the range between 1 and 99.
4. Press the "Start/Stop" button.
 - Confirm the setting and go to menu item "FE: 7".
 - The display shows "FE" and the number of currently defined error strokes that are permissible during normal dosing operation.
5. Use the "Up" and "Down" buttons to set the number of error strokes until the error message is triggered during normal dosing operation in the range between 3 and 99.
6. Press the "Start/Stop" button
 - to confirm the new settings
 - to exit the service level
 - to open the first function level.

9.10.7 Calibrating the sensor after the sensor has been replaced

Once a sensor has been replaced, the new sensor must be calibrated to the ambient pressure.

Prepare the pump for the calibration:

1. Before screwing in the sensor, check that no dosing liquid is left in the place where the pressure sensor will be screwed in!
2. Screw in the new sensor with the correctly fitting O-ring.
3. Screw the sensor plug into socket 2.
4. Unscrew the suction valve.

Calibration of sensor

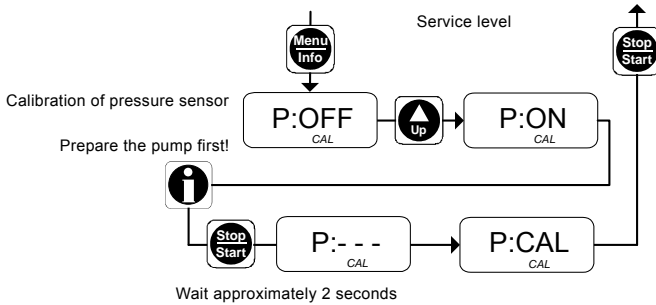


Fig. 64 Calibration of pressure sensor

1. Open the service level.
2. Repeatedly press the "Menu/Info" button to navigate in the service level until you reach menu item "P" (calibration of pressure sensor).
 - "P:OFF" appears in the display.
3. Press the "Up" button to prepare the calibration.
 - "P:ON" appears in the display.

When the pump is prepared for the calibration, calibrate the pressure sensor:

1. Press the "Start/Stop" button.
 - "P:- - -" is displayed for approximately 2 seconds.
 - "P:CAL" appears in the display.
 - The pressure sensor has been calibrated.
2. Press the "Start/Stop" button
 - to confirm the new settings
 - to exit the service level
 - to open the first function level.
3. Fit the pump back on.
4. Screw in the suction valve.

Warning

Risk of chemical burns!



Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Do not allow any chemicals to leak from the pump. Collect and dispose of all chemicals correctly!

The O-rings must be correctly placed in the specified groove.

Caution

Observe the flow direction (indicated by an arrow)!

Only tighten the valve by hand.

9.11 Batch menu / batch mode

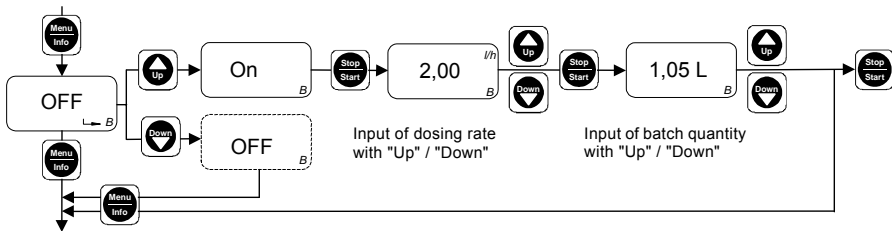
In batch mode, a defined batch quantity is dosed with a defined dosing flow. The batch can be dosed manually or by an external contact signal.

Risk of dosing errors!

Batch dosing using contact inputs may be insufficiently or excessively triggered in the event of an error if the pump/system is not monitored. The system must be protected redundantly.

Caution

Setting batch dosing



TM03 6615 4506

Fig. 65 Setting batch dosing

In the second function level, "OFF B" appears in the display.

1. Press the "Up" button.
 - "ON B" appears in the display.
2. Press the "Start/Stop" button.
 - The currently defined flow rate appears in the display.
3. Use the "Up" and "Down" buttons to enter the desired flow rate.
4. Press the "Start/Stop" button.
 - The currently defined batch quantity appears in the display.
5. Use the "Up" and "Down" buttons to enter the desired batch quantity.
 - Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
 - press the "Start/Stop" button (confirm the setting, close the second function level and enable batch dosing in the first function level).

Performing batch dosing

- In the first function level, only the batch function is displayed with the "Batch manual" and "Batch contact" menu items.
- "Stop" and the preset batch quantity appear in the display. The LED lights up red.

Use the "Menu/Info" button to select

- "Batch manual", or
- "Batch contact".

Batch mode is controlled at the first and second function levels.

- The batch quantity is set in the second function level.
- The batch function is enabled in the first function level.

Input range for the batch quantity:

0.0-999.9 ml / 1.00-99.99 l.

Enabling batch mode

Batch manual

Batch dosing is triggered manually.

- Press the "Start/Stop" button.
 - The LED and the "Stop" segment are turned off and "Run" flashes in the display.
 - The preset batch quantity is dosed.

Batch contact

Batch dosing is triggered by an external contact signal.

To activate the batch contact function,

- press the "Start/Stop" button.
 - The LED lights up green, the "Stop" segment is turned off and "Run" appears in the display.

When the external contact signal is received, "Run" flashes in the display.

- The preset batch quantity is dosed.

During batch dosing

The batch quantity still to be dosed appears in the display.

To display the batch quantity already dosed,

- press the "Down" button.

To display the total batch quantity,

- press the "Up" button.

Stop/start of pump during batch dosing

To stop the pump,

- press the "Start/Stop" button, or
- actuate remote on/off.

To restart the pump,

- press the "Start/Stop" button.
 - The preset batch cycle continues.
 - For the "Contact" timer, an external contact signal must also be received.

Deactivating the batch function

1. Open the second function level.
2. Repeatedly press the "Menu/Info" button.
 - "ON B" appears in the display.
3. Press the "Up" button.
 - "OFF B" appears in the display.
 - The batch function is deactivated.

9.12 Timer menu / timer mode

In timer mode, a defined batch quantity is dosed with a defined dosing flow. The first dosing starts after the start time t_1 has elapsed. Batch dosing is then repeated after the repetition time t_2 has elapsed until the user stops the process by pressing the "Start/Stop" button or with remote off.

- Input range for the batch quantity:
0.0-999.9 ml / 1.00-99.99 l.
- Input range for the times t_1 and t_2 :
1 min. < t_1 < 999 h / 1 min. < t_2 < 999 h.
Input: hh:mm.

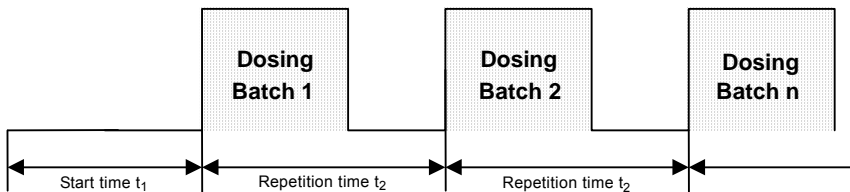


Fig. 66 Timer mode

Risk of dosing errors!

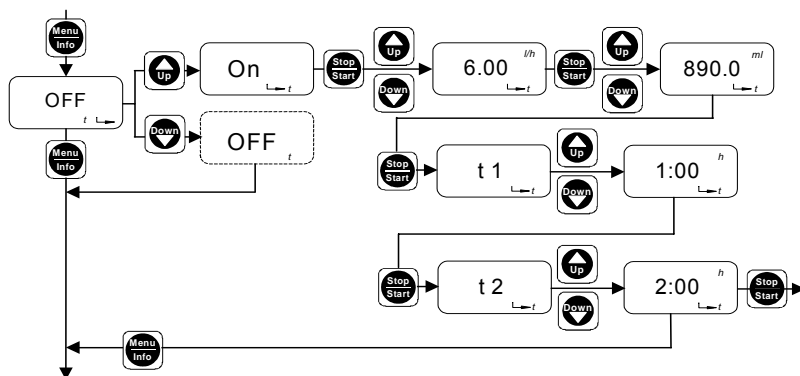
If repetition time t_2 is not long enough to dose the batch quantity at the set dosing flow within this time, the pump continues dosing until the current batch quantity is finished. The pump is then stopped and the next batch dosing is triggered after the next repetition time.

Caution

Batch dosing in timer mode may be insufficiently or excessively triggered in the event of an error if the pump/system is not monitored. The system must be protected redundantly.

Timer mode is controlled at the first and second function levels.

- The batch quantity and times t_1 and t_2 are set in the second function level.
- Timer mode is enabled in the first function level.



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Fig. 67 Setting timer mode

"OFF t" appears in the display.

1. Press the "Up" button.
 - "ON t" appears in the display.
2. Press the "Start/Stop" button.
3. Use the "Up" and "Down" buttons to enter the desired dosing flow.
 - The selected dosing flow appears in the display.
4. Press the "Start/Stop" button.
5. Use the "Up" and "Down" buttons to enter the desired batch quantity.
 - The selected batch quantity appears in the display.
6. Press the "Start/Stop" button.
 - "t1" appears in the display.
7. Use the "Up" and "Down" buttons to enter start time t_1 .
8. Press the "Start/Stop" button.
 - "t2" appears in the display.
9. Use the "Up" and "Down" buttons to enter repetition time t_2 .
 - Press the "Menu/Info" button (confirm the setting and move on to the next menu item), or
 - press the "Start/Stop" button (confirm the setting, close the second function level and enable timer mode in the first function level).

Selecting "Manual" or "Contact" timer mode

- When the pump is running (LED lights up green), press the "Start/Stop" button.
 - "Stop" and the preset start time t_1 appear in the display. The LED lights up red.
 - "Manual" or "Contact" appears in the display ("Manual" is default setting).

In the first function level, only the timer function is displayed with the "Timer manual" and "Timer contact" menu items.

- Use the "Menu/Info" button to select
 - "Timer manual", or
 - "Timer contact".

Enabling timer mode

Timer manual

Batch dosing with the preset pause time is triggered manually.

- Press the "Start/Stop" button.
 - The LED lights up green, the "Stop" segment is turned off and "Run" flashes in the display.
 - The preset batch cycle is started.

Timer contact

Batch dosing with the preset pause time is triggered by an external contact signal.

To activate the batch contact function,

- press the "Start/Stop" button.
 - The LED lights up green, the "Stop" segment is turned off and "Run" appears in the display.

When the external contact signal is received, "Run" flashes in the display.

- The preset batch cycle is started.

During pause times

The time remaining until the next dosing appears in the display.

To display the time already elapsed,

- press the "Down" button.

To display the total time t_1 or t_2 ,

- press the "Up" button.

During timer dosing

The batch quantity still to be dosed appears in the display.

To display the batch quantity already dosed,

- press the "Down" button.

To display the total batch quantity,

- press the "Up" button.

Stop/start of pump during timer dosing

To stop the pump,

- press the "Start/Stop" button, or
- actuate remote on/off.

To restart the pump,

- press the "Start/Stop" button.
 - The preset batch cycle continues.
 - For the "Contact" timer, an external contact signal must also be received.

Deactivating the timer function

1. Open the second function level.
2. Repeatedly press the "Menu/Info" button.
 - "ON t" appears in the display.
3. Press the "Up" button.
 - "OFF t" appears in the display.
 - The timer function is deactivated.

9.13 Creating a master/slave application

You can connect several secondary pumps and control the secondary pumps (slaves) via the first pump (master).

9.13.1 Master

All operating modes are available for the master pump:

- Manual
- Contact
- Batch dosing with manual/contact start
- Timer mode with manual/contact start
- Current control.

Select the output signal of the master pump in the service level (relay 1) (output socket 3):

- Stroke signal (emits one output signal per stroke) must be used for manual or current control of the master pump, or
- pulse input (emits one output signal per contact input signal) must be used for contact control of the master pump.

Alternatively select the current output (output socket 2) for current control of the slave pump.

Please note that the current output can differ from the current input, e.g. when the pump is stopped, and please observe the modified current output values with weighted current control.

Note

9.13.2 Slave

The following operating modes are available for slave pumps in contact or current control (input socket 4):

- Contact
- Batch dosing with contact start
- Timer mode with contact start
- Current control.

The settings for the operating modes of the slave pumps are implemented independently of settings for the master pump.

Note

Unused pulse inputs from the master pump are forwarded to the slave pumps when output signal = pulse input is set. They are processed on the slave pumps according to the slave pump settings!

Caution

9.14 Hotkeys / info keys

The following important displays and functions of the DDI 209 can be accessed quickly using button combinations (hotkeys).

Service functions

Function	Operating state of the pump	Activate function / display	Deactivate function / display
Deerate.	In "Run", "Stop" or "Menu/Info" mode.	Press the "Start/Stop" button for at least 1 second.	Release the "Start/Stop" button.
Move back the diaphragm for servicing.	The pump must be in "Stop" mode.	Simultaneously press the "Up" and "Down" buttons.	—
Boot function.	The pump is disconnected from the power supply.	Simultaneously press the "Up" and "Down" buttons while switching on the power supply.	—
Delete the total dosing capacity.	In "Run" mode.	Press the "Menu/Info" button for 5 seconds.	—

Display functions in batch and timer operation

Display / function	Operating state of the pump	Activate function / display	Deactivate function / display
Display the batch quantity already dosed since start of the batch.	During the batch dosing in batch or timer operation.	Press the "Down" button.	Release the "Down" button.
Display total batch quantity.		Press the "Up" button.	Release the "Up" button.
Display the time that has already elapsed.	During pause times in timer operation.	Press the "Down" button.	Release the "Down" button.
Display the total time.		Press the "Up" button.	Release the "Up" button.

Other display functions

Display / function	Operating state of the pump	Activate function / display	Deactivate function / display
Display the total dosing capacity.	In "Run" mode.	Press the "Menu/Info" button.	Display automatically jumps back after 5 seconds.
Display the input current.	In "Analog" mode (0-20 mA / 4-20 mA).	Press the "Down" button.	

10. Maintenance

10.1 General notes

Warning

When dosing dangerous media, observe the corresponding safety precautions!



Risk of chemical burns!

Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Do not allow any chemicals to leak from the pump. Collect and dispose of all chemicals correctly!

Warning

The pump housing must only be opened by personnel authorised by Grundfos Afdos!



Repairs must only be carried out by authorised and qualified personnel!

Switch off the pump and disconnect it from the power supply before carrying out maintenance work and repairs!

10.2 Maintenance intervals

In the event of a diaphragm leakage, the dosing liquid may leak out of the hole in the intermediate flange between the pump and the dosing head. The parts inside the housing are protected from the dosing liquid for a short time (depending on the type of liquid) by the housing sealing. It is necessary to check regularly (daily) if liquid is leaking out of the intermediate flange.

Caution

For maximum safety, we recommend the pump version with diaphragm leakage detection.

- At least every 12 months or after 4,000 operating hours. When dosing crystallising liquids, more frequently.
- In the event of a fault.

10.2.1 Cleaning the valves and diaphragm

- Clean the diaphragm and valves and replace, if necessary (for stainless-steel valves: inner valve parts).

10.3 Cleaning suction and discharge valves

Note

If possible, rinse the dosing head, e.g. by supplying it with water.

10.3.1 Switching off the pump

1. Switch off the pump and disconnect it from the power supply.
2. Depressurise the system.
3. Take suitable steps to ensure that the returning dosing medium is safely collected.

10.3.2 Unscrewing the priming chamber valve (Plus³ system)

When using the Plus³ system, unscrew the priming chamber valve (3c) as follows:

1. Remove the cover (L) from the priming chamber.
2. Remove the valve tube (R) with the valve (3c).
3. Unscrew the valve (3c) from the valve tube.

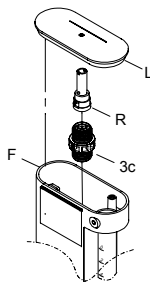


Fig. 68 Priming chamber valve

10.3.3 Unscrewing suction and discharge valves/cleaning valves

1. Unscrew the suction and discharge valves.
2. Dismantle the inner valve parts:
 - Standard DN 4/DN 8 valve:
 - Carefully push out the inner valve part using a thin wire nail (or paper clip) in the flow direction (see arrow on the valve body).
 - Dismantle the inner parts: seat (4r), O-ring (1r), balls (3r), ball cages (2r).

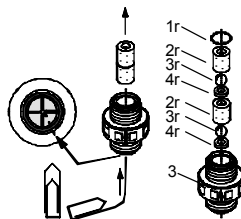


Fig. 69 Standard DN 4/DN 8 valve

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TM03 6265 4506

- Spring-loaded DN 4/DN 8 valve:
 - Unscrew the valve cover.
 - Dismantle the inner parts (as shown in fig. 70).

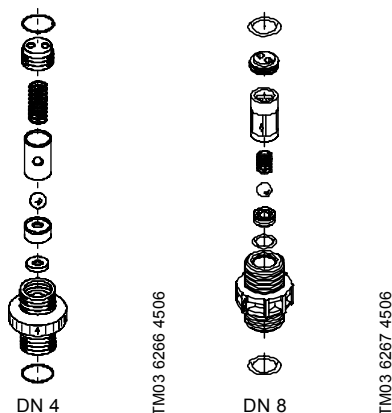


Fig. 70 Spring-loaded DN 4 valve / spring-loaded DN 8 valve

3. Clean all parts.

If faulty parts are detected, proceed as follows:

- Replace the valve (for stainless-steel valves: inner valve parts).
For contents and product numbers of the spare parts kits, contact Grundfos Alldos.

4. Re-assemble and refit the valve.

5. Remove the deaeration cartridge (1p, 2p, 3p) under the discharge valve from the dosing head using a pair of tweezers.

- Dismantle the cartridge.
- Clean the cartridge.

If faulty parts are detected, proceed as follows:

- Replace the deaeration cartridge.
For contents and product numbers of the spare parts kits, contact Grundfos Alldos.
- Re-assemble the cartridge.

6. Refit all parts.

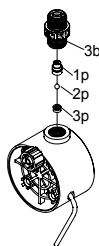


Fig. 71 Standard DN 4/DN 8 valve

The O-rings must be correctly placed in the specified groove.

Caution Observe the flow direction (indicated by an arrow)!

Only tighten the valve by hand.

10.4 Replacing the diaphragm

Warning

Risk of chemical burns!



Wear protective clothing (gloves and goggles) when working on the dosing head, connections or lines!

Do not allow any chemicals to leak from the pump. Collect and dispose of all chemicals correctly!

Note

If possible, rinse the dosing head, e.g. by supplying it with water.

10.4.1 Resetting the diaphragm

When replacing the diaphragm, it must be at the back dead point (end of suction stroke). As the stroke usually ends at the front dead point, reset the diaphragm as follows:

- With the pump stopped (LED lights up red), press the "Up" and "Down" buttons simultaneously.
 - The diaphragm is reset.

10.4.2 Switching off the pump

1. Switch off the pump and disconnect it from the power supply.
2. Depressurise the system.
3. Take suitable steps to ensure that the returning dosing medium is safely collected.

10.4.3 Replacing the diaphragm

See fig. 72 or 73.

1. Loosen the four screws (1q + 2q) on the dosing head (2).
2. Remove the dosing head (2).
3. Unscrew the diaphragm (Q) counter-clockwise.
 - For pumps without Plus³ system:
Replace the sealing diaphragm (3q), intermediate ring (4q) and support disk (5q).
4. Screw in the new diaphragm (Q).
5. Replace the dosing head (2) and cross-tighten the screws (1q + 2q).
Maximum torque:
DDI 0.4 - DDI 5.5: 2.1 Nm.
DDI 13.8 - DDI 20: 2.5 Nm.
6. Vent and start up the dosing pump.

After initial start-up and after each time the diaphragm is changed, tighten the dosing head screws.

After approximately 6-10 operating hours or two days, cross-tighten the dosing head screws using a torque wrench.

Caution

Maximum torque:

DDI 0.4 - DDI 5.5: 2.1 Nm.

DDI 13.8 - DDI 20: 2.5 Nm.

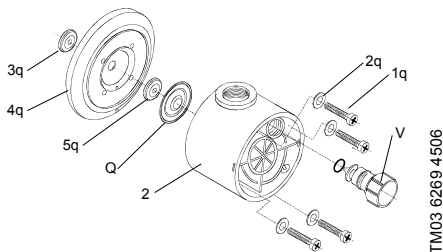


Fig. 72 Replacing diaphragm without Plus³ system

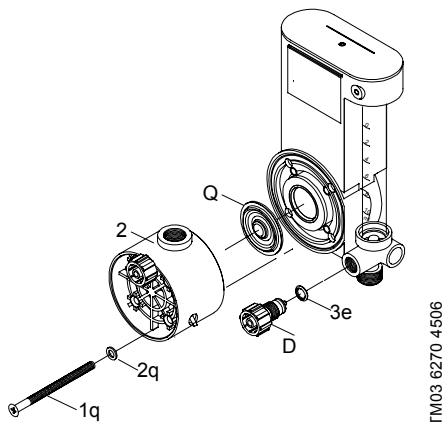


Fig. 73 Replacing diaphragm with Plus³ system

11. Fault finding chart

Fault	Cause	Remedy
1. Dosing pump does not run.	a) Not connected to the mains.	Connect the power supply cable.
	b) Incorrect mains voltage.	Switch off the pump. Check voltage and motor. If the motor is faulty, return the pump for repair.
	c) Electrical failure.	Return the pump for repair.
2. Dosing pump does not suck in.	a) Leaking suction line.	Replace or seal the suction line.
	b) Cross-section of the suction line too small or suction line too long.	Check with Grundfos Alldos specification.
	c) Clogged suction line.	Rinse or replace the suction line.
	d) Foot valve covered by sediment.	Suspend the suction line from a higher position.
	e) Buckled suction line.	Install the suction line correctly. Check for damage.
	f) Crystalline deposits in the valves.	Clean the valves.
	g) Diaphragm broken or diaphragm tappet torn out.	Replace the diaphragm.
	h) Empty dosing tank.	Fill the dosing tank.
3. Dosing pump does not dose.	a) Air in the suction line and dosing head.	Fill the dosing head and suction line.
	b) Viscosity or density of medium too high.	Check the installation.
	c) Crystalline deposits in the valves.	Clean the valves.
	d) Valves not correctly assembled.	Assemble the inner valve parts in the right order and check or possibly correct the flow direction.
	e) Injection unit blocked.	Check and possibly correct the flow direction, or remove the obstruction.
	f) Incorrect installation of lines and peripheral equipment.	Check the lines for free passage and correct installation.
	g) Empty dosing tank.	Fill the dosing tank.
	h) Sealing elements not chemically resistant.	Replace sealing elements.

Fault	Cause	Remedy
4. Dosing flow of the pump is inaccurate.	a) Dosing head not fully deaerated.	Repeat the deaeration.
	b) Degassing medium.	Check the installation.
	c) Parts of the valves covered in dirt or incrusted.	Clean the valves.
	d) Counter-pressure fluctuations.	Install a pressure-loading valve and a pulsation damper, if necessary.
	e) Suction lift fluctuations.	Keep the suction level constant.
	f) Siphon effect (inlet pressure higher than counter-pressure).	Install a pressure-loading valve.
	g) Leaking or porous suction line or discharge line.	Replace the suction line or discharge line.
	h) Parts in contact with the medium are not resistant to it.	Replace with resistant materials.
	i) Dosing diaphragm worn (incipient tears).	Replace the diaphragm. Also observe the maintenance instructions.
	j) Variation of the dosing medium (density, viscosity).	Check the concentration. Use an agitator, if necessary.
5. Loud, piercing noises.	a) At dosing capacities lower than 10 % of the maximum dosing capacity of the pump, resonance noises may temporarily occur at the stepper motor.	The resonance noise of the stepper motor does not indicate an error.
6. Liquid leaks out of the hole in the intermediate flange between the pump and the dosing head.	a) A diaphragm leakage has occurred.	Replace the diaphragm.

Note For further error signals for the control unit, refer to the relevant section.

12. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use appropriate waste collection services.
2. If this is not possible, contact the nearest Grundfos or Grundfos Alldos company or service workshop.

Safety declaration

Please copy, fill in and sign this sheet and attach it to the pump returned for service.

We hereby declare that this product is free from hazardous chemicals, biological and radioactive substances:

Product type: _____

Model number: _____

No media or water: _____

A chemical solution, name: _____

(see pump nameplate)

Fault description

Please make a circle around the damaged part.

In the case of an electrical or functional fault, please mark the cabinet.



Please give a short description of the fault:

Date and signature

Company stamp

GrA3494

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SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.16 Harmsco 5 micron and 1 micron filter cartridges

Model # Harmsco –HUR 170 HP

Harmsco – HUR 3X170FL

Tag # 5MF & 1MF

INSTALLATION & OPERATION MANUAL

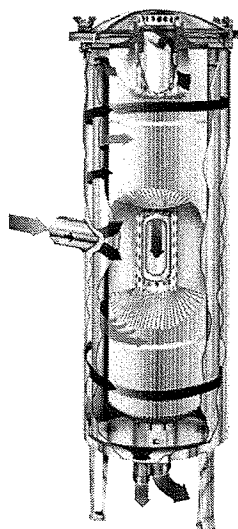
HARMSCO® HURRICANE® FILTERS

HARMSCO® Hurricane® Filters provide exceptionally long filter runs, reduced maintenance and lower filtration costs when used as combination centrifugal separator and cartridge filter or in conventional filtration applications.

HOW THEY WORK

Centrifugal Separation to Remove Dense Particles from Liquids

Liquid enters the Hurricane filter's outer chamber tangentially, producing a rotational flow. This flow pattern creates a centrifugal force which is used to separate dense particles such as sand, rust, grit and metal fines from liquids. Heavy particles drop to the bottom of the filter's outer chamber where they are discharged manually, automatically or continuously. With the dense particles removed, liquid and light solids rise up, over and into an inner chamber where the rotational flow is continued.



Up-flow Cartridge Filtration and Angled Pleats for Lightweight Particle Removal

Trapped air is automatically purged due to principal of up-flow filtration. Filtered liquid exits the filter at the highest point, as it is filtered. A secure top plate prevents cross contamination of filtered and unfiltered liquid. This patented up-flow design allows Harmsco to utilize 100% of cartridge surface area, providing efficient filtration. Filter efficiencies are dramatically improved to provide longer filter runs and reduced filtration costs. Harmsco® Hurricane® filter cartridges for the Waterbetter® filters are available in a wide range of micron ratings and may be cleaned and re-used in most applications and most micron ratings.

Modeling & Specifications
REVIEWED ACCORDING TO THE
REQUIREMENTS OF THE GENERAL
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THE
REQUIREMENTS and specifications
are as follows:

- ☒ REVIEWED
- ☐ MAKE NOTED CORRECTIONS
- ☐ REVISE & RESUBMIT

DATE: July 9, BY: K.B.
2a/c

SPECIFICATION

Flow rate (GPM)
Filter area (pleated)
Pipe sizes, inlet & outlet
Pipe size, drain
Filter height
Filter diameter
Floor space required
Service height clearance
Shipping weight (approx.)
Temperature rating*

HUR 40 HP

Up to 50
40 sq. ft.
2" NPT
1" NPT
21"
13"
15"x15"
31"
40 lbs.
140° (60°C)

HUR 90 HP

Up to 100
90 sq. ft.
2" NPT
1" NPT
31"
13"
15"x15"
51"
51 lbs.
140° (60°C)

HUR 170 HP

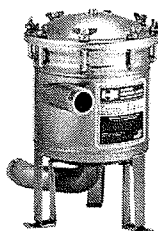
Up to 150
170 sq. ft.
2" NPT
1" NPT
41"
13"
15"x15"
72"
64 lbs.
140° (60°C)

*Varies based on pressure and time under load.

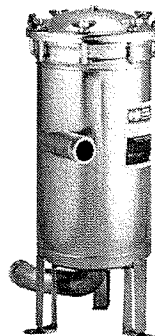
Features

Product features include:

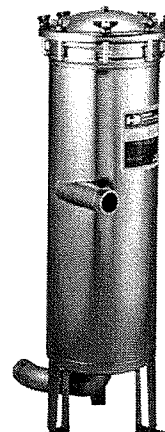
- 304 stainless steel filter housings
- Electro-polished for superior finish
- Resistant coatings available
- Fail-safe lids with individual studs for security
- Brass wing-nuts for convenience
- 90° elbow and 45° sweep on outlet for in-line vertical installation
- CPVC standpipe for up-flow design
- Choice of cartridges available



HUR 40 HP



HUR 90 HP



HUR 170 HP

INSTALLATION & OPERATION MANUAL

HARMSCO® HURRICANE® FILTERS

HARMSCO® Hurricane® Filters provide exceptionally long filter runs, reduced maintenance and lower filtration costs when used as combination centrifugal separator and cartridge filter or in conventional filtration applications.

HOW THEY WORK

Centrifugal Separation to Remove Dense Particles from Liquids

Liquid enters the Hurricane filter's outer chamber tangentially, producing a rotational flow. This flow pattern creates a centrifugal force which is used to separate dense particles such as sand, rust, grit and metal fines from liquids. Heavy particles drop to the bottom of the filter's outer chamber where they are discharged manually, automatically or continuously. With the dense particles removed, liquid and light solids rise up, over and into an inner chamber where the rotational flow is continued.



Up-flow Cartridge Filtration and Angled Pleats for Lightweight Particle Removal

Trapped air is automatically purged due to principal of up-flow filtration. Filtered liquid exits the filter at the highest point, as it is filtered. A secure top plate prevents cross contamination of filtered and unfiltered liquid. This patented up-flow design allows Harmsco to utilize 100% of cartridge surface area, providing efficient filtration. Filter efficiencies are dramatically improved to provide longer filter runs and reduced filtration costs. Harmsco® Hurricane® filter cartridges for the Waterbetter® filters are available in a wide range of micron ratings and may be cleaned and re-used in most applications and most micron ratings.

Models & Specifications

Three Hurricane® Filter models are available for a wide range of applications. Models and specifications are as follows:

SPECIFICATION	HUR 40 HP	HUR 90 HP	HUR 170 HP
Flow rate (GPM)	Up to 50	Up to 100	Up to 150
Filter area (pleated)	40 sq. ft.	90 sq. ft.	170 sq. ft.
Pipe sizes, inlet & outlet	2" NPT	2" NPT	2" NPT
Pipe size, drain	1" NPT	1" NPT	1" NPT
Filter height	21"	31"	41"
Filter diameter	13"	13"	13"
Floor space required	15"x15"	15"x15"	15"x15"
Service height clearance	31"	51"	72"
Shipping weight (approx.)	40 lbs.	51 lbs.	64 lbs.
Temperature rating*	140° (60°C)	140° (60°C)	140° (60°C)

**Varies based on pressure and time under load.*

Features

Product features include:

- 304 stainless steel filter housings
- Electro-polished for superior finish
- Resistant coatings available
- Fail-safe lids with individual studs for security
- Brass wing-nuts for convenience
- 90° elbow and 45° sweep on outlet for in-line vertical installation
- CPVC standpipe for up-flow design
- Choice of cartridges available



HUR 40 HP

HUR 90 HP

HUR 170 HP

Temperature & Pressure Ratings

Hurricane® Filters are rated for pressures to 150 psi and temperatures to 140°F.

Sizing

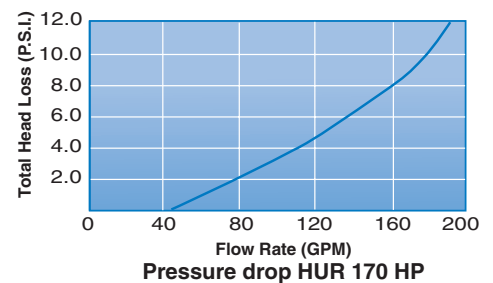
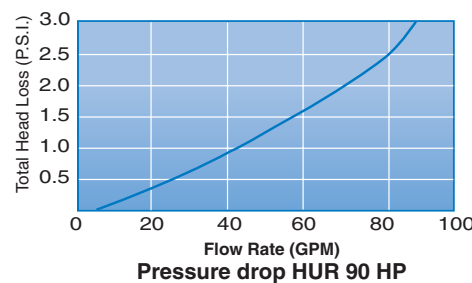
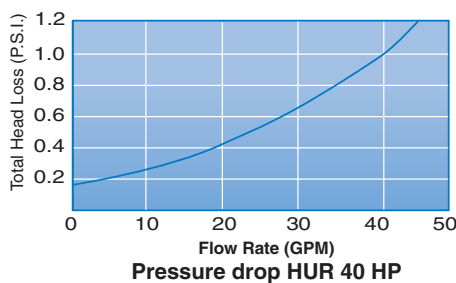
Use the chart shown below to size Hurricane® Filters for your application:

Flow Rate	Recommended Model	Pleated Filter Area
Up to 50 GPM	HUR 40 HP	40 sq. ft.
Up to 100 GPM	HUR 90 HP	90 sq. ft.
Up to 150 GPM	HUR 170 HP	170 sq. ft.
Up to 300 GPM	HUR 170 HP (two filters*)	340 sq. ft. (two filters*)
Up to 450 GPM	HUR 170 HP (three filters*)	510 sq. ft. (three filters*)
Up to 600 GPM	HUR 170 HP (four filters*)	680 sq. ft. (four filters*)
Up to 750 GPM	HUR 170 HP (five filters*)	850 sq. ft. (five filters*)

*Parallel installation with valves to isolate filters for service while other filters are operational.

Pressure Drop

The total head loss data shown below was developed by NSF International and indicates pressure drop with Hurricane® Filter and one micron filter cartridge in clean water.



Harmsco® Hurricane® Replacement Cartridges

Hurricane® replacement cartridges are available in a wide range of nominal ratings, shown right.

Cartridges are rated for temperatures to 140°F and may be used to separate solids in liquids with a pH of 3 to 11.

Packaged one cartridge per carton.



Filter Model	Cartridge Product Code	Nominal Micron	Cartridge Dimensions			Ship Wt./Ctn. (One Cartridge)
HUR 40 HP	HC/40-0.35	0.35	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-1	1	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-5	5	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-10	10	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-20	20	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-50	50	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-100	100	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/40-150	150	9 5/8"	7 3/4"	3" FPT	4 lbs.
HUR 90 HP	HC/40-EZ-CLEAN	NR*	9 5/8"	7 3/4"	3" FPT	4 lbs.
	HC/90-0.35	0.35	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-1	1	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-5	5	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-10	10	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-20	20	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-50	50	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-100	100	19 1/2"	7 3/4"	3" FPT	7 lbs.
HUR 170 HP	HC/90-150	150	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/90-EZ-CLEAN	NR*	19 1/2"	7 3/4"	3" FPT	7 lbs.
	HC/170-0.35	0.35	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-1	1	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-5	5	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-10	10	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-20	20	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-50	50	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-100	100	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-150	150	30 3/4"	7 3/4"	3" FPT	10 lbs.
	HC/170-EZ-CLEAN	NR*	30 3/4"	30 3/4"	3" FPT	10 lbs.

Activated carbon and Poly-Pleat Hurricane® cartridges available. Please see catalog.

* NR - not rated

Cartridge Cleaning Instructions

Hurricane® cartridges are made of Polyester Plus™, a proprietary blend of polyester fibers which can be cleaned in most applications and micron ratings to make Hurricane® filter elements reusable! For best results, follow the directions described below:

When Cartridge Cleaning is Possible

Clean cartridge when pressure differential is 12 psi above startup differential.

Non-cleanable Applications

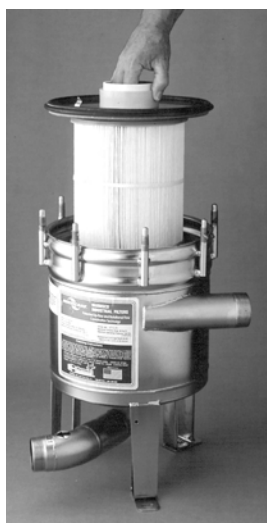
Replace cartridge when pressure differential is 30 psi above start-up differential or when flow has diminished to an unacceptable level, indicating cartridge is at capacity.

Cartridge Removal

To remove filter cartridge, drain filter housing. Remove wing-nuts and lid. Hold cross-bar in retainer nut and pull upward to remove filter cartridge and top plate from filter housing. Follow cleaning instructions described herein.

Lid Replacement

Replace wing-nuts systematically, rotating around filter. "Finger tight" is normally sufficient. However, in extreme duty applications it may be necessary to tighten to 75 inch lbs. of torque. Over-tightening can cause damage to the rim gasket.



Cartridge Cleaning in Aqueous Applications

For best results, clean cartridges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate (see photo). Follow these directions to remove oils, organic matter, algae and mineral deposits.



Caution: Do not rinse cartridges with acid until oils and organic matter are removed. Use detergent first and follow with acid bath for mineral removal. Flush cartridges with water after muriatic or tri-sodium phosphate baths.

OILS: Soak cartridge in a solution of tri-sodium phosphate or similar strong detergent (2 lbs. to 10 gallons of water). Soak up to 12 hours for best results. Rinse after bath.

ORGANIC MATTER, ALGAE: Use tri-sodium phosphate solution as described above, plus 1 pint of liquid chlorine to kill organic matter and algae. Soak cartridge one hour or longer until surface is no longer "slippery." Rinse after bath.

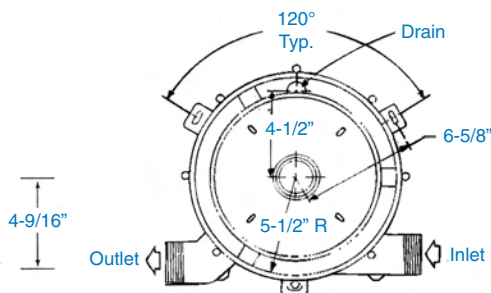
CALCIUM MINERAL DEPOSITS: Follow directions for "oils" described above. Soak cartridge for approximately ten minutes in a solution of one part of muriatic acid to twenty parts of water. Rinse cartridge thoroughly with water.

When Cartridge Cleaning is Not Possible

Generally, it is not possible to clean Hurricane® filter cartridges when filtering petroleum-base liquids, toxic substances, and one and below micron applications.

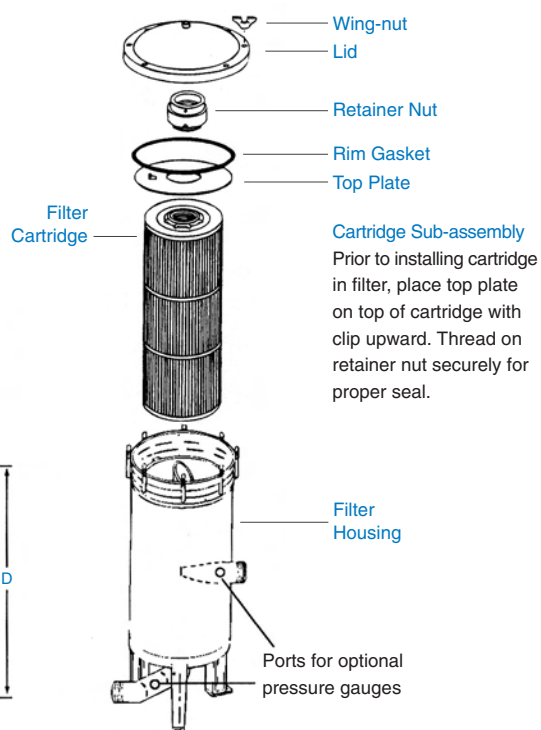
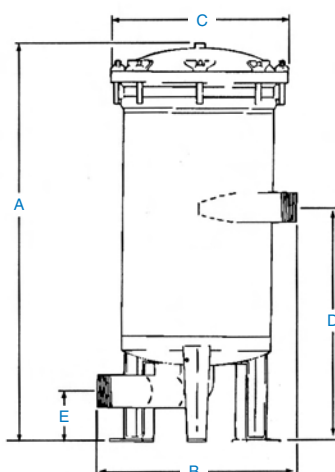
Note: Pressure gauges are recommended to indicate when cartridge cleaning or replacement is necessary.

Model	A Height	B Width	C Diameter	D Inlet	E Outlet
HUR 40 HP	19 1/2"	14 5/8"	13"	12 3/4"	3 7/16"
HUR 90 HP	29 7/8"	14 5/8"	13"	17 3/4"	3 7/16"
HUR 170 HP	40 1/2"	14 5/8"	13"	23 5/8"	3 7/16"



Pressure Gauges

Install optional pressure gauges in gauge ports as shown above. Use pressure differential to indicate when to clean or replace cartridge.



Installation

Install filter using 2" couplers for inlet and outlet with 1" coupler for drain pipe. Shut-off valves should be installed on inlet, outlet and on drain pipe to be able to service the filter and isolate it when necessary.

Pressure gauges are also recommended before and after the filter to easily calculate the pressure differential and to know when cartridge should be cleaned or replaced. Threaded flanged fittings for inlet and outlet are available by special order.

1/4" FPT Lid Fitting

One-quarter inch FPT fittings are installed in Waterbetter® Filter lids for a number of customer supplied options, including petcock for pressure relief, pressure gauge, sensor, thermocouple, etc. This fitting should be plugged at time of installation if one of these options is not installed.



Harmsco, Inc. Industrial Filters Limited Warranty

1. Harmsco, Inc. warrants its line of Industrial Filters to be free of defects in material and workmanship for a period of one year from the date of installation.
2. The warranty for Industrial Filters ordered with special coatings is limited only to the recoating of the defective parts due to failure in materials or workmanship for one year from date of installation.
3. This warranty does not cover any equipment purchased for use in applications in which the product is not suited. It is the responsibility of the buyer to determine if a product is suitable for a particular application.
4. THIS WARRANTY EXCLUDES THE FOLLOWING:
 - a. Any fresh water unit installed for salt water use.
 - b. Damage caused by improper installation, operation or care.
 - c. Chemical attack.
 - d. Rubber type parts and normal wear items, i.e. "o" rings, rim gaskets, wing nuts, pipe caps, holding rods.
 - e. Any costs of labor or expenses incurred in the removal and/or installation of Unit, or any surrounding device.
 - f. Damage caused by galvanic or electrolytic attack.
 - g. Altering or removing the Harmsco, Inc. information label.
 - h. Any unit not grounded.
5. Service under this warranty is to be provided by the dealer/distributor who sold the unit to the distributor. If the dealer/distributor is unable to provide warranty service, contact:

Harmsco, Inc. P.O. Box 14066
North Palm Beach, Florida 33408, U.S.A.
Phone (561) 848-9628 • Fax (561) 845-2474

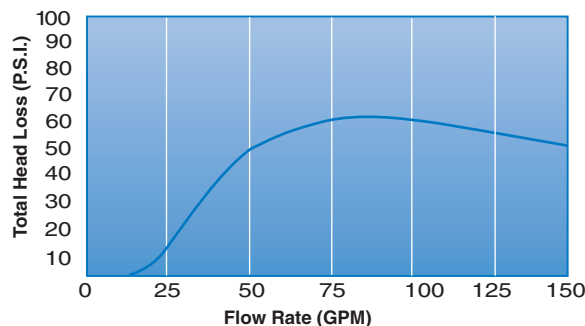
A Returned Goods Authorization (RGA) number must be received from the above office and placed on all shipments to and correspondence with Harmsco, Inc. Please be prepared with the following information:

1. Model number and serial number
2. Date of installation
3. Name of installer
4. Nature of problem
5. Your address and telephone number.

Particle Separation

Particle separation with Hurricane® filters is influenced by particle weight and flow rate. For optimum separation, the drain valve should be opened routinely by hand or automatically using a timer actuated valve. Automatic purge valves are not available from Harmsco. However, for more information regarding this equipment, please contact the Authorized Harmsco Distributor in your area.

The data shown below was developed through tests conducted with Hurricane® filters and twenty micron filter cartridges to determine optimum flow rates for particle separation. Sand was used as the test's particulate with a specific gravity of 2.6 relative to water at 1.0. This data is provided for general sizing purposes only. Results vary and depend on the particulate being filtered, viscosity and other variables.



Tests indicate the separation of performance of all three Hurricane® filters were essentially the same up to the rated flow rate of each model.

Part List

Hurricane® Filter parts and components are listed below:

Part No.	Material	Description
550-E	EPDM	Rim gasket to seal filter
905-P	PVC	Retainer nut for filter cartridge
309SS	Stainless steel	Top plate
312	PVC	Retainer nut insert
530-AC	Stainless steel	Lid with vent
316-C	CPVC	Standpipe for HUR 40 HP
317-C	CPVC	Standpipe for HUR 90 HP
315-C	CPVC	Standpipe for HUR 170 HP
202-B	Brass	Wing-nut
329	CPVC	Inner vessel isolator
330	Stainless steel	Screw 1/4" x 1/2" for isolator

Options:

550-B	Buna-N	Rim gasket to seal filter
550-V	Viton	Rim gasket to seal filter
327	Stainless steel	2" Flange fittings (set of 2)

Available From:



HARMSCO® Filtration Products

P.O. Box 14066 • North Palm Beach, FL 33408

800.327.3248 • 561.848.9628 • Fax: 561.845.2474 • E-mail: sales@harmsco.com

www.harmsco.com



003 4/07

SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.17 Little Giant Sump Pump

Model # 6E-CIA-SFS

Tag # P-300

**6E-CIA-SFS
6E-CIA-RFSN
6E-CIM**

GB INTRODUCTION

This instruction sheet will provide you with information required to safely own and operate Little Giant 6E Series pumps. The pump you have purchased is a submersible effluent pump for use in basins or lift stations and suitable for pumping sewage, effluent, wastewater and other non-explosive, non-corrosive liquids with up to 1/2 inch spherical solids.

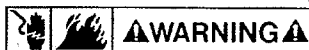
This instruction sheet covers the standard models in this pump series. This form is applicable to other models in this series not listed by catalog number in the replacement parts list section of this pamphlet. If the catalog number of your pump is not listed in the replacement parts section, then caution should be exercised when ordering replacement parts. Always give the catalog number of your pump when ordering replacement parts.

The Little Giant unit you have purchased is of the highest quality workmanship and material. It has been engineered to give you long and trouble-free service.

The Little Giant pumps are carefully packaged, inspected and tested to insure safe operation and delivery. When you receive your pump, examine it carefully to determine that there are no broken or damaged parts that may have occurred during shipment. If damage has occurred, make notation and notify the firm that you purchased the pump from. They will assist you in replacement parts if required.

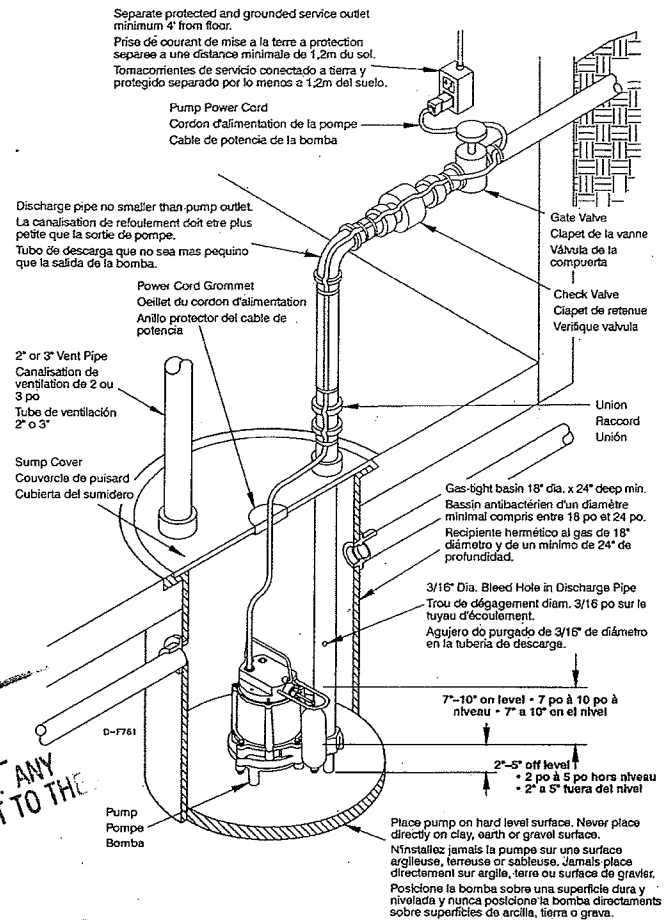
READ INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE ANY LITTLE GIANT PUMP. KNOW THE PUMP APPLICATION, LIMITATIONS, AND POTENTIAL HAZARDS. PROTECT YOURSELF AND OTHERS BY OBSERVING ALL SAFETY INFORMATION. FAILURE TO COMPLY WITH INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE! RETAIN INSTRUCTIONS FOR FUTURE REFERENCE.

SAFETY GUIDELINES



1. Make certain pump is disconnected from power source before attempting to service or remove any component.
2. Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. **DO NOT** use in explosive atmospheres or hazardous locations as classified by NEC, ANSI/NFPA. Pump should be used with liquids compatible with pump component materials.
3. Do not handle the pump with wet hands or when standing on a wet or damp surface or in water.
4. Do not pull the pump out of the water by the power cord when the pump is operating or connected to power source.
5. This pump is supplied with a grounding conductor and/or grounding type attachment plug. To reduce the risk of electrical shock, be certain that it is connected to a properly grounded grounding type receptacle.
6. The National Electric Code requires a ground fault circuit interrupter (GFCI) be installed in the branch circuit supplying fountain equipment, pools, etc.

**Figure 1. Typical Installation • Installation Type
• Instalacion Tipica**



In any installation where property damage and/or personal injury might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) and/or alarm should be used.

Support pump and piping when assembling and when installed. Failure to do so may cause piping to break, pump to fail, motor bearing failures, etc.

9. This pump's motor housing is filled with a dielectric oil for motor heat transfer and lifetime lubrication of the bearings. This oil is non-toxic to aquatic life. However, suffocation can occur if oil is left on the water surface. If oil escapes the motor housing it can be removed from the surface quickly by placing newspapers on the water surface to soak up the oil.
10. The pump motor is equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of excessively high or low voltage, inadequate wiring, incorrect motor connections, or a defective motor or pump.

ELECTRICAL CONNECTIONS



1. Check the pump label for proper voltage required. Do not connect to voltage other than that shown.
2. If pump is supplied with a 3-prong electrical plug, the third prong is to ground the pump to prevent possible electrical shock hazard. **DO NOT REMOVE** the third prong from the plug. A separate branch circuit is recommended. Do not use

**6E-CIA-SFS
6E-CIA-RFSN
6E-CIM**

GB INTRODUCTION

This instruction sheet will provide you with information required to safely own and operate Little Giant 6E Series pumps. The pump you have purchased is a submersible effluent pump for use in basins or lift stations and suitable for pumping sewage, effluent, wastewater and other non-explosive, non-corrosive liquids with up to 1/2 inch spherical solids.

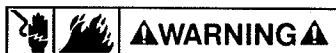
This instruction sheet covers the standard models in this pump series. This form is applicable to other models in this series not listed by catalog number in the replacement parts list section of this pamphlet. If the catalog number of your pump is not listed in the replacement parts section, then caution should be exercised when ordering replacement parts. Always give the catalog number of your pump when ordering replacement parts.

The Little Giant unit you have purchased is of the highest quality workmanship and material. It has been engineered to give you long and trouble-free service.

The Little Giant pumps are carefully packaged, inspected and tested to insure safe operation and delivery. When you receive your pump, examine it carefully to determine that there are no broken or damaged parts that may have occurred during shipment. If damage has occurred, make notation and notify the firm that you purchased the pump from. They will assist you in replacement or repair, if required.

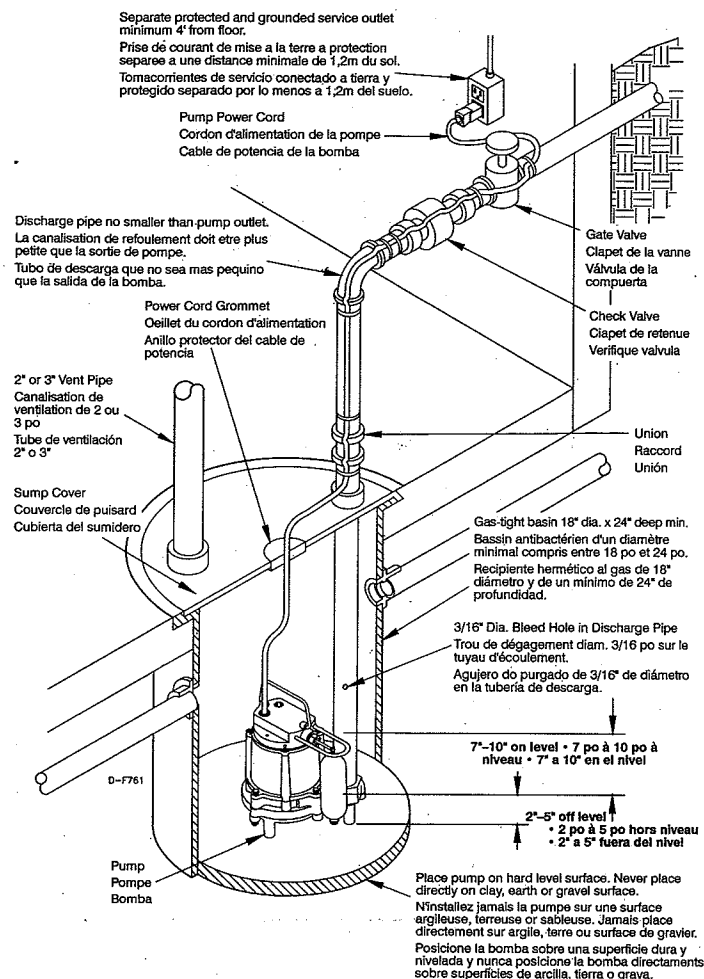
READ INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THE LITTLE GIANT PUMP. KNOW THE PUMP APPLICATION, LIMITATIONS, AND POTENTIAL HAZARDS. PROTECT YOURSELF AND OTHERS BY OBSERVING ALL SAFETY INFORMATION. FAILURE TO COMPLY WITH INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE! RETAIN INSTRUCTIONS FOR FUTURE REFERENCE.

SAFETY GUIDELINES



1. Make certain pump is disconnected from power source before attempting to service or remove any component.
2. Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. **DO NOT** use in explosive atmospheres or hazardous locations as classified by NEC, ANSI/NFPA. Pump should be used with liquids compatible with pump component materials.
3. Do not handle the pump with wet hands or when standing on a wet or damp surface or in water.
4. Do not pull the pump out of the water by the power cord when the pump is operating or connected to power source.
5. This pump is supplied with a grounding conductor and/or grounding type attachment plug. To reduce the risk of electrical shock, be certain that it is connected to a properly grounded grounding type receptacle.
6. The National Electric Code requires a ground fault circuit interrupter (GFCI) be installed in the branch circuit supplying fountain equipment, pools, etc.

**Figure 1. Typical Installation • Installation Type
• Instalacion Tipica**



7. In any installation where property damage and/or personal injury might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) and/or alarm should be used.
8. Support pump and piping when assembling and when installed. Failure to do so may cause piping to break, pump to fail, motor bearing failures, etc.
9. This pump's motor housing is filled with a dielectric oil for motor heat transfer and lifetime lubrication of the bearings. This oil is non-toxic to aquatic life. However, suffocation can occur if oil is left on the water surface. If oil escapes the motor housing it can be removed from the surface quickly by placing newspapers on the water surface to soak up the oil.
10. The pump motor is equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of excessively high or low voltage, inadequate wiring, incorrect motor connections, or a defective motor or pump.

ELECTRICAL CONNECTIONS



1. Check the pump label for proper voltage required. Do not connect to voltage other than that shown.
2. If pump is supplied with a 3-prong electrical plug, the third prong is to ground the pump to prevent possible electrical shock hazard. **DO NOT REMOVE** the third prong from the plug. A separate branch circuit is recommended. Do not use

an extension cord. Do not cut plug from the cord. If the plug is cut or the cord is shortened, then this action will void the warranty.

3. If the cord is equipped with stripped lead wires, such as on 230v models, be sure that the lead wires are connected to a power source correctly. The (green/yellow) wire is the ground. The (blue or white) and (brown or black) are live.
4. Check local electrical and building codes before installation. The installation must be in accordance with their regulations as well as the most recent National Electrical Code (NEC).
5. To conform to the National Electrical Code all pumps must be wired with 14 AWG or larger wire. For runs to 250 feet 14 AWG wire is sufficient. For longer runs consult a qualified electrician or the factory.
6. Pump should be connected or wired to its own circuit with no other outlets or equipment in the circuit line. Fuses and circuit breaker should be of ample capacity in the electrical circuit.
7. The flexible PVC jacketed cord assembly mounted to the pump must not be modified in any way, with the exception of shortening the cord to fit into a control panel. Any splice between the pump and the control panel must be made within a junction box and mounted outside of the basin and comply with the National Electrical Code.

CONSULT INSTRUCTION SHEET ILLUSTRATIONS FOR PROPER ASSEMBLY AND DISSASSEMBLY OF YOUR LITTLE GIANT PUMP.

OPERATION

1. Pump must be installed in a suitable gas tight basin which is at least 18" in diameter and 24" deep, and vented in accordance with local plumbing codes.
2. Pump features a 1½" female NPT discharge.
3. Pump must be placed on a hard level surface. Never place pump directly on clay, earth or gravel surfaces.
4. A check valve must be used in the discharge line to prevent back flow of liquid into the basin. The check valve should be a free flow valve that will easily pass solids.
CAUTION: For best performance of check valves, when handling solids install in a horizontal position or at an angle of no more than 45 degrees. Do not install check valve in a vertical position as solids may settle in valve and prevent opening on start-up.
5. Do not attempt to restrict the intake side of these pumps. Restricting the intake may cause damage to the seal and may starve the pump. If you require reduced flow rates, then place a valve on the discharge side of the pump or if flexible vinyl tubing is used, a clamp can be used on the tubing to restrict the flow.
6. Do not let the unit run dry (without liquid). It is designed to be cooled by pumping fluid. You may damage the seal and the motor may fail if the pump is allowed to run dry.
7. If the unit is going to be idle for a period of time, follow the cleaning instructions outlined in the next section. Do not let the unit freeze in the wintertime. This may cause cracking or distortion that may destroy the unit.

TESTING PUMP OPERATION

1A SERIES EFFLUENT PUMPS

1. These pumps are equipped with a float operated mechanical switch.
2. When these pumps are installed in a basin with a sealed cover, switch operation cannot be observed. The sump cover usually will have a spare that is plugged with a rubber plug. This plug can be removed and switch operation can be observed.

3. Plug power cord into a grounded receptacle with voltage consistent with pump voltage as indicated on pump nameplate.
4. Run water into pump until pump starts.
5. Be sure gate valve in discharge line is open.
6. Allow pump to operate through several on off cycles.

CIM SERIES EFFLUENT PUMPS

1. The pump cord for these pumps can be plugged directly into a properly grounded receptacle with voltage consistent with pump nameplate for continuous pump operation.

CAUTION: This type of operation should be used only for emergency use or when a large volume of water is to be pumped. Pump must not be allowed to run dry. If pump is run dry, it may damage pump and void the warranty.

SERVICE INSTRUCTIONS



MAKE CERTAIN THE UNIT IS DISCONNECTED FROM THE POWER SOURCE BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENT!

1. If pump does not operate properly, consult the troubleshooting chart. If trouble cannot be located with these steps shown, consult your pump dealer or take pump to a Little Giant authorized service center.
2. This unit is permanently lubricated. Oiling is not required. Do not, in any case, open the sealed portion of the unit or remove housing screws.
3. Periodic cleaning of the pump parts will prolong the LIFE and EFFICIENCY of the pump. Refer to the assembly and disassembly of the pumping head.
4. Remove screws that hold base to volute and clean impeller and volute passage. Do not use strong solvents on impeller.
5. Be sure impeller turns freely after cleaning.
6. **WARNING: DO NOT REMOVE IMPELLER. REMOVAL OF IMPELLER REQUIRES SPECIAL TOOLS AND IS TO BE DONE ONLY BY AN AUTHORIZED SERVICE CENTER.**
DO NOT REMOVE MOTOR HOUSING COVER. WARRANTY IS VOID IF MOTOR HOUSING COVER, IMPELLER OR SEALS HAVE BEEN REMOVED. ANY REPAIR ON MOTOR MUST BE DONE BY AN AUTHORIZED LITTLE GIANT SERVICE CENTER.
7. Be certain power cord is in good condition and contains no nicks or cuts.

INTRODUCTION

Cette liste de directives vous fournit les renseignements nécessaires pour utiliser une pompe de la série 6E Little Giant en toute sécurité. Vous avez acheté une pompe pour effluent submersible pouvant être utilisée dans des bassins ou dans des stations de pompage des eaux usées. Elle permet de pomper les eaux d'égout, l'effluent, les eaux usées et d'autres liquides non explosifs et non corrosifs pouvant contenir des solides d'un diamètre de 1/2 po.

La présente feuille d'instructions décrit les modèles standard de cette série de pompe. Ce document s'applique également à d'autres modèles de cette série qui ne sont pas indiqués par leur numéro de catalogue dans la section des pièces de remplacement du présent document. Si tel était le cas avec votre pompe, il faudra être particulièrement attentif au moment de commander des pièces. Toujours donner le numéro de catalogue de votre pompe lors de la commande de pièces.

Votre nouvelle pompe Little Giant a été fabriquée avec les meilleurs matériaux et avec le plus grand soin. Elle a été conçue pour fonctionner bien et longtemps.

SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

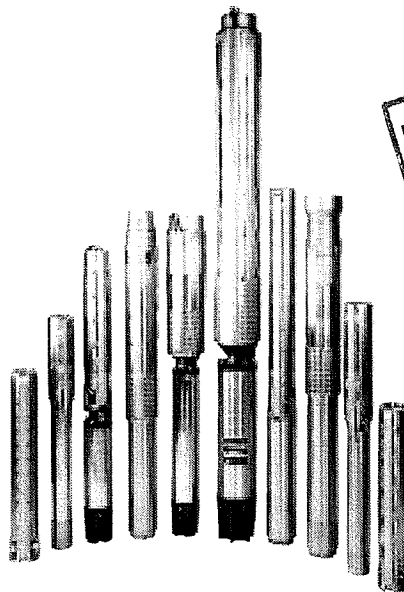
9.3.18 Grundfos Raw Water Pump

Model # 230S75-2

Tag # P-001 & P-002

6", 8" & 10" STAINLESS STEEL SUBMERSIBLE PUMPS

Installation and Operating Instructions



REVIEWED ACCORDING TO THE
REQUIREMENTS OF THE GENERAL
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THE
REQUIREMENTS.

☒ REVIEWED
☐ MAKE NOTED CORRECTIONS
☐ REVISE & RESUBMIT

DATE: July 9, 2010 BY: K.B.

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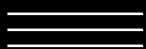
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Wire Cable Type	2	Troubleshooting	10-14
Splicing the Motor Cable	3	Technical Data	15-21
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Please leave these instructions with the pump for future reference.

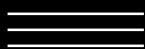
GRUNDFOS



Leaders in Pump Technology



SAFETY WARNING



Grundfos Stainless Steel Submersible Pumps

Your Grundfos Submersible Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Submersible Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not dropped or mishandled.**

The motor is equipped with an electrical cable. Under no circumstance should the cable be used to support the weight of the pump.

You will find a loose data plate with an adhesive backing with the pump. The nameplate should be completed in pen and attached to the control box.

Pre-Installation Checklist

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

A. Condition of the Well

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. The stainless steel construction of the Grundfos submersible make it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy water.

If this pump is used to replace an oil-filled submersible or oil-lubricated line-shaft turbine in an existing well, **the well must be blown or bailed clear of oil.**

Determine the maximum depth of the well, and the draw-down level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

B. Condition of the Water

Submersible pumps are designed for pumping clear and cold water that is free of air and gases. Decreased pump performance and life expectancy can occur if the water is not cold and clear or contains air and gasses.

Maximum water temperature should not exceed 102°F. Special consideration must be given to the pump and motor if it is to be used to pump water above 102°F.

The Grundfos stainless steel submersible is highly resistant to the normal corrosive environment found in some water wells. If water well tests determine the water has an excessive or unusual corrosive quality, or exceeds 102°F, contact your Grundfos representative for information concerning specially designed pumps for these applications.

C. Installation Depth

A check should be made to ensure that the installation depth of the pump will always be at least (5) five to (10) ten feet below the maximum draw-down level of the well. For flow rates exceeding 100 gpm, refer to performance curves for recommended minimum submergence.

The bottom of the motor should never be installed lower than the top of the well screen or within five feet of the well bottom.

If the pump is to be installed in a lake, pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

D. Electrical Supply

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

Wire Cable Type

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor may be solid or stranded. The cable may consist of individually insulated conductors twisted together, insulated conductors molded side by side in one flat cable or insulated conductors with a round overall jacket.

The conductor insulation should be type RW, RUW, TW, TWU or equivalent and must be suitable for use with submersible pumps. An equivalent Canadian Standards Association certified wire may also be used. See Table D for recommended sizes of cable lengths.

Splicing the Motor Cable

A good cable splice is critical to proper operation of the submersible pump and must be done with extreme care.

If the splice is carefully made, it will work as well as any other portion of the cable, and will be completely watertight.

Grundfos recommends using a heat shrink splice kit. The splice should be made in accordance with the kit manufacture's instructions. Typically a heat shrink splice can be made as follows:

1. Examine the motor cable and the drop cable carefully for damage.
2. Cut the motor leads off in a staggered manner. Cut the ends of the drop cable so that the ends match up with the motor leads (See Figure 4-A). On single-phase motors, be sure to match the colors.
3. Strip back and trim off 1/2 inch of insulation from each lead, making sure to scrape the wire bare to obtain a good connection. Be careful not to damage the copper conductor when stripping off the insulation.
4. Slide the heat shrink tubing on to each lead. Insert a properly sized "Sta-kon" type connector on each lead, making sure that lead colors are matched. Using a "Sta-kon" crimping pliers, indent the lugs (Figure 4-B). Be sure to squeeze hard on the pliers, particularly when using large cable.
5. Center the heat shrink tubing over the connector. Using a propane torch, lighter, or electric heat gun, uniformly heat the tubing starting first in the center working towards the ends (Figure 4-C).
6. Continue to apply the heat to the tubing using care not to let the flame directly contact the tubing. When the tubing shrinks and the sealant flows from the ends of the tubing, the splice is complete (Figure 4-D).

FIGURE 4-A

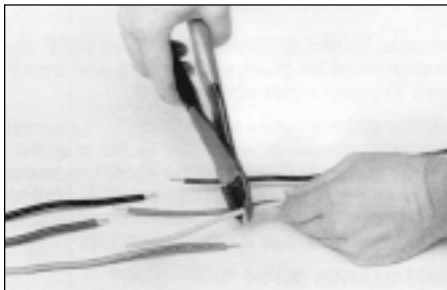


FIGURE 4-B

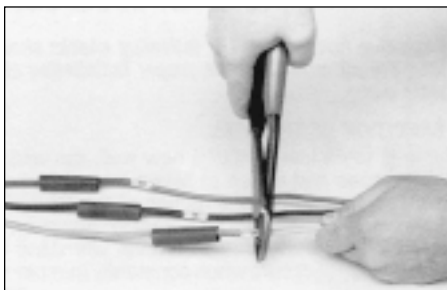


FIGURE 4-C

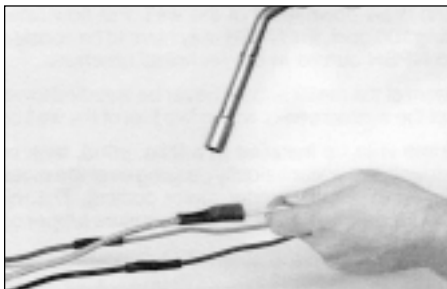
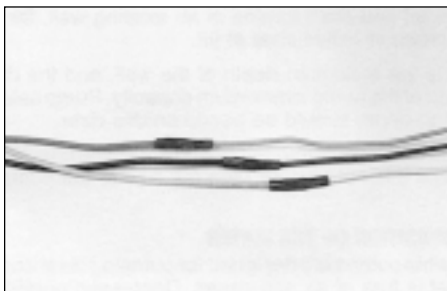


FIGURE 4-D



Installation

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

If An Adapter Needs To Be Installed:

It is recommended to first install the drop pipe to the pipe adapter. Then install the drop pipe with the adapter to the pump discharge.

A back-up wrench should be used when the riser pipe is attached to the pump. The pump should be gripped only by the flats on the top of the discharge chamber. The body of the pump, cable guard or motor should not be gripped under any circumstance.

If Steel Riser Pipe Is Used:

We recommend that steel riser pipes always be used with the larger submersibles. An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

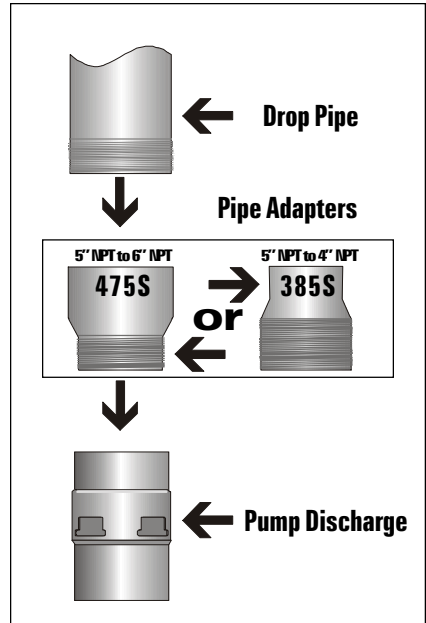
After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above and below the splice.

If Plastic or Flexible Riser Pipe Is Used:

It is recommended that plastic type riser pipe be used only with the smaller domestic submersibles. The pipe manufacturer or representative should be contacted to insure the pipe type and physical characteristics are suitable for this use. Use the correct joint compound recommended by the pipe manufacturer. In addition to making sure that joints are securely fastened, the use of a torque arrester is recommended when using plastic pipe.



Installation

Do not connect the first plastic or flexible riser section directly to the pump. Always attached a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping and possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above each joint.

IMPORTANT – Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave 3 to 4 inches of slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. As a general rule, you can estimate that plastic pipe will stretch to approximately 2% of its length. For example, if you installed 200 feet of plastic riser pipe, the pump may actually be down 204 feet. If the depth setting is critical, check with the manufacturer of the pipe to determine who to compensate for pipe stretch.

When plastic riser pipe is used, it is recommended that a safety cable be attached to the pump to lower and raise it.

Check valves:

A check valve should always be installed at the surface of the well. In addition, for installations deeper than 200 feet, check valves should be installed at no more than 200 foot intervals.

Protect the well from contamination:

To protect against surface water entering the well and contaminating the water source, the well should be finished off above grade, and a locally approved well seal or pitless adapter unit utilized.

Electrical

WARNING: To reduce the risk of electrical shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table E.

If voltage variations are larger than $\pm 10\%$, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current. If direct on-line starting is not acceptable and reduced starting current is required, an auto-transformer or resistant starters should be used for 5 to 30 HP motors (depending on cable length). For motors over 30 HP, use auto-transformer starters.

Engine-Driven Generators

If the submersible pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

If power is going to be supplied through transformers, Table C outlines the minimum KVA rating and capacity required for satisfactory pump operation.

Control Box/Panel Wiring

1. Single-Phase Motors:

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 6-A).

2. Three-Phase Motors:

Three-phase motors must be used with the proper size and type of motor starter to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overload current. A properly sized starter with ambient-compensated extra quick-trip overloads must be used to give the best possible motor winding protection. **Each of the three motor legs must be protected with overloads.** The thermal overloads must trip in less than 10 seconds at locked rotor (starting) current. For starter and overload protection guide, see Table H. A three-phase motor wiring diagram is illustrated below (See Figure 6-B).

Pumps should NEVER be started to check rotation unless the pump is totally submerged. Severe damage may be caused to the pump and motor if they are run dry.

FIGURE 6-A

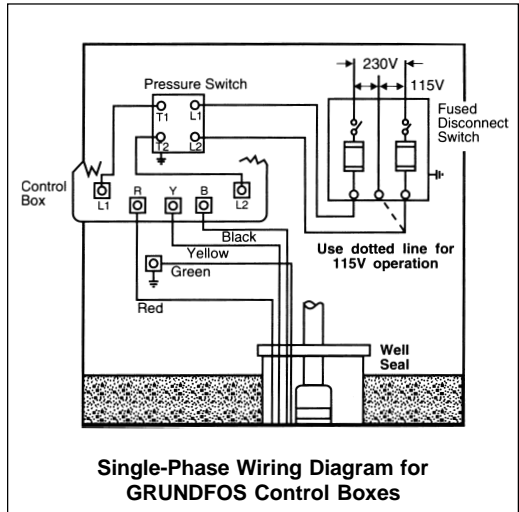
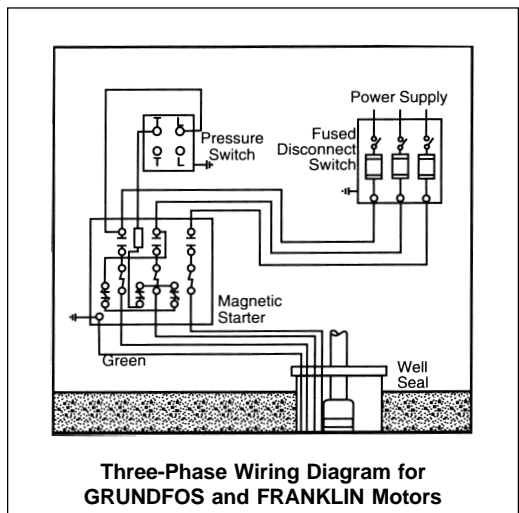


FIGURE 6-B



Electrical

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. Lightning voltage surges in power lines are caused when lightning strikes somewhere in the area. Switching surges are caused by the opening and closing of switches on the main high-voltage distribution power lines.

The correct voltage-rated surge arrester should be installed on the supply (line) side of the control box (Figure 6-C and 6-D). The arrester must be grounded in accordance with the National Electrical Code and local codes and regulations

FIGURE 6-C

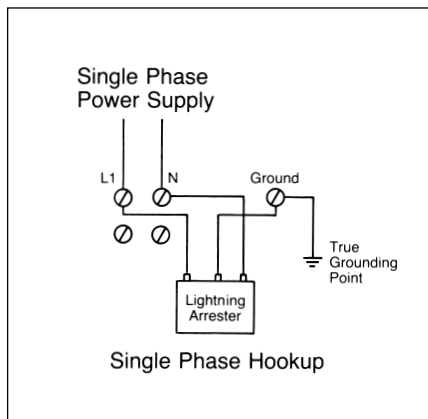
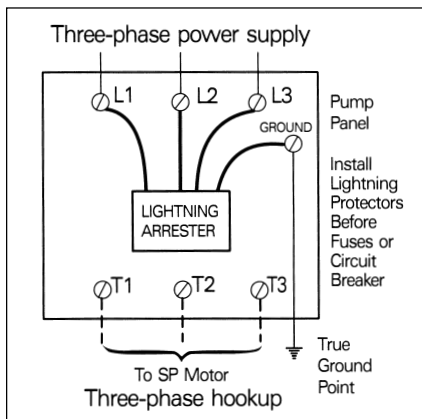


FIGURE 6-D



The warranty on all three-phase submersible motors is VOID if:

- 1. The motor is operated with single-phase power through a phase converter.**
- 2. Three-leg ambient compensated extra quick-trip overload protectors are not used.**
- 3. Three-phase current unbalance is not checked and recorded. (See START-UP Section 7 for instructions.)**
- 4. High voltage surge arresters are not installed.**

Control Box/Panel Grounding

The control box or panel shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used or if a grounding wire is required by local codes, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

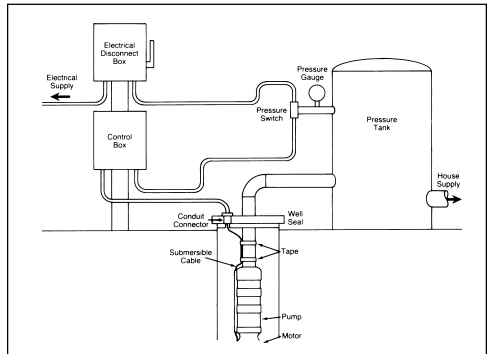
Operating Procedures

Wiring Checks and Installation

Before making the final surface wiring connection of the drop cable to the control box or panel, it is a good practice to check the insulation resistance to ensure that the cable and splice are good. Measurements for a new installation must be at least 2,000,000 ohm. Do not start the pump if the measurement is less than this.

If it is higher than 2,000,000 ohm, the drop cable should then be run through the well seal by means of a conduit connector in such a way as to eliminate any possibility of foreign matter entering the well casing. Conduit should always be used from the pump to the control box or panel to protect the drop cable (See Figure 6-E). Finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box or panel and high voltage surge arrester have been grounded.

FIGURE 6-E



Start-Up

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

- Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
- Adjust the gate valve one-third of the way open.
- On three-phase units, check direction of rotation and current unbalance according to the instructions below. For single-phase units proceed directly to "Developing the Well."
- Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Three-Phase Motors

1. Check the direction of rotation

Three-phase motors can run in either direction depending on how they are connected to the power supply. When the three cable leads are first connected to the power supply, there is a 50% chance that the motor will run in the proper direction. To make sure the motor is running in the proper direction, carefully follow the procedures below:

- Start the pump and check the water quantity and pressure developed.
- Stop the pump and interchange any two leads.
- Start the pump and again check the water quantity and pressure.
- Compare the results observed. The wire connection which gave the highest pressure and largest water quantity is the correct connection.

Start-Up

2. Check for current unbalance

Current unbalance causes the motor to have reduced starting torque, overload tripping, excessive vibration and poor performance which can result in early motor failure. It is very important that current unbalance be checked in all three-phase systems. **Current unbalance between the legs should not exceed 5% under normal operating conditions.**

The supply power service should be verified to see if it is a two or three transformer system. If two transformers are present, the system is an "open" delta or wye. If three transformers are present, the system is true three-phase.

Make sure the transformer ratings in kilovolt amps (KVA) is sufficient for the motor load. See Table C.

The percentage of current unbalance can be calculated by using the following formulas and procedures:

$$\text{Average current} = \frac{\text{Total of current values measured on each leg}}{3}$$
$$\% \text{ Current unbalance} = \frac{\text{Greatest amp difference from the average}}{\text{average current}} \times 100$$

To determine the percentage of current unbalance:

- A. Measure and record current readings in amps for each leg (hookup 1). Disconnect power.
- B. Shift or roll the motor leads from left to right so the drop cable lead that was on terminal 1 is now on 2, lead on 2 is now on 3, and lead on 3 is now on 1 (hookup 2). Rolling the motor leads in this manner will not reverse the motor rotation. Start the pump, measure and record current reading on each leg. Disconnect power.
- C. Again shift drop cable leads from left to right so the lead on terminal 1 goes to 2, 2 to 3 and 3 to 1 (hookup 3). Start pump, measure and record current reading on each leg. Disconnect power.
- D. Add the values for each hookup.
- E. Divide the total by 3 to obtain the average.
- F. Compare each single leg reading from the average to obtain the greatest amp difference from the average.
- G. Divide this difference by the average to obtain the percentage of unbalance.

Use the wiring hookup which provides the lowest percentage of unbalance. (See Table F for a specific example of correcting for three-phase power unbalance.)

Developing the Well

After proper rotation and current unbalance have been checked, start the pump and let it operate until the water runs clear of sand, silt and other impurities.

Slowly open the valve in small increments as the water clears until the desired flow rate is reached. Do not operate the pump beyond its maximum flow rating. **The pump should not be stopped until the water runs clear.**

Start-Up

If the water is clean and clear when the pump is first started, the valve should still be **slowly opened until the desired flow rate is reached**. As the valve is being opened, the drawdown should be checked to ensure the pump is always submerged. **The dynamic water level should always be more than 3 feet above the inlet strainer of the pump.**

Disconnect the temporary piping arrangements and complete the final piping connections.

Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

Operation

1. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling and operation of controls.
2. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 8.

Troubleshooting

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following chart covers most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks before pulling the pump from the well.

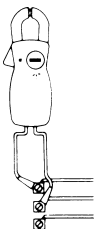
Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. **WARNING:** Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

Troubleshooting

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box or starter.

On single-phase units, measure between line and neutral.

On three-phase units, measure between the legs (phases).

What it Means

When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box or starter. See Electrical Data, Table E, for motor amp draw information.

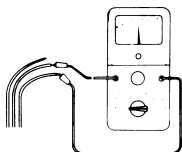
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA) or if the current unbalance is greater than 5% between each leg on three-phase units, check for the following:

1. Burnt contacts on motor starter.
2. Loose terminals in starter or control box or possible cable defect. Check winding and insulation resistances.
3. Supply voltage too high or low.
4. Motor windings are shorted.
5. Pump is damaged, causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table E. Cable resistance values are in Table G.

What it Means

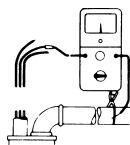
If all the ohm values are normal, and the cable colors correct, the windings are not damaged.

If any one ohm value is less than normal, the motor may be shorted.

If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open.

If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table E.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohm or mega ohmmeter, set the scale selector to Rx 100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What it Means

For ohm values, refer to table below. Motors of all HP, voltage, phase and cycle duties have the same value of insulation resistance.

Troubleshooting Chart

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor.
1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
500,000 - 1,000,000	0.5 - 1.0	Motor in well (Ohm readings are for drop cable plus motor): A motor in reasonably good condition.
20,000 - 500,000	0.02 - 0.5	A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.
10,000 - 20,000	0.01 - 0.02	A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long.
less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

A. Pump Does Not Run

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
3. Motor starter overloads are burnt or have tripped out (three-phase only).	Check for voltage on line or load side of starter.	Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.
4. Starter does not energize (three-phase only).	Energize control circuit and check for voltage at the holding coil.	If no voltage, check control circuit. If voltage, check holding coil for shorts. Replace bad coil.
5. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
6. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
7. Defective capacitor (single-phase only).	Turn off the power, then discharge capacitor. Check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

Troubleshooting Chart

B. Pump Runs But Does Not Deliver Water

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Groundwater level in well is too low or well is collapsed.	Check well draw-down. Water level should be at least 3 ft. above pump inlet during operation.	If not, lower pump if possible, or throttle discharge valve and install water level control.
2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet. (For water: $\text{PSI} \times 2.31 \text{ ft/PSI} = \text{ft.}$), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and re-install.
3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and re-install.
4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.

C. Pump Runs But at Reduced Capacity

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Wrong rotation (three-phase only).	Check for proper electrical connection in control panel.	Correct wiring and change leads as required.
2. Draw-down is larger than anticipated.	Check draw-down during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
3. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
4. Pump strainer or check valve are clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and re-install.
5. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.

Troubleshooting Chart

D. Pump Cycles Too Much

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
3. Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume.	Repair or replace damaged component.
4. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.
5. Tank is too small.	Check tank size. Tank volume should be approximately 10 gallons for each gpm or pump capacity.	If tank is too small, replace with proper size tank.

E. Fuses Blow or Circuit Breakers Trip

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. High or low voltage.	Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
2. Three-phase current unbalance.	Check current draw on each lead. Unbalance must be within $\pm 5\%$.	If current unbalance is not within $\pm 5\%$, contact power company.
3. Control box wiring and components (single-phase only).	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
4. Defective capacitor (single-phase only).	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
5. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

Technical Data

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
6"	8	30
	6	10
	7	28
	8	45
	10	85
	12	140
8"	14	198
	16	275
	8	10
	10	55
	12	110
10"	14	180
	16	255
	10	30
	12	85
	14	145
	16	220
	18	305

NOTES:

1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.
3. The minimum recommended water velocity over 6, 8, and 10" motors is 0.5 feet per second.

Table C

Transformer Capacity Required for Three-Phase Submersible Pump Motors

THREE-PHASE MOTOR HP	MINIMUM TOTAL KVA REQUIRED*	MINIMUM KVA RATING FOR EACH TRANSFORMER	
		2 TRANSFORMERS OPEN DELTA OR WYE	3 TRANSFORMERS DELTA OR WYE
1.5	3	2	1
2	4	2	1-1/2
3	5	3	2
5	7-1/2	5	3
7.5	10	7-1/2	5
10	15	10	5
15	20	15	7-1/2
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40
125	150	85	50
150	175	100	60
200	230	130	75

* Pump motor KVA requirements only, and does not include allowances for other loads.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP SINGLE OR THREE PHASE UNITS	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0
2.0	7.5	4.0
3.0	10.0	5.0
5.0	15.0	7.5
7.5	20.0	10.0
10.0	30.0	15.0
15.0	40.0	20.0
20.0	60.0	25.0
25.0	75.0	30.0
30.0	100.0	40.0
40.0	100.0	50.0
50.0	150.0	60.0
60.0	175.0	75.0
75.0	250.0	100.0
100.0	300.0	150.0
125.0	375.0	175.0
150.0	450.0	200.0
200.0	600.0	275.0

NOTES:

1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single-phase and three-phase motors.
2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
3. If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 1.25 to obtain KVA.

Table D

Submersible Pump Cable Selection Chart (60 Hz)

The following tables list the recommended copper cable sizes and various cable lengths for submersible pump motors.

These tables comply with the 1978 edition of the National Electric Table 310-16, Column 2 for 75°C wire. The ampacity (current carrying properties of a conductor) have been divided by 1.25 per the N.E.C., Article 430-22, for motor branch circuits based on motor amps at rated horsepower.

To assure adequate starting torque, the maximum cable lengths are calculated to maintain 95% of the service entrance voltage at the motor when the motor is running at maximum nameplate amps. Cable sizes larger than specified may always be used and will reduce power usage.

The use of cables smaller than the recommended sizes will void the warranty. Smaller cable sizes will cause reduced starting torque and poor motor operation.

Single-Phase Motor Maximum Cable Length (Motor to service entrance) (2)

VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300
115	1/3	130	210	340	540	840	1300	1960	2910					
	1/2	100	160	250	390	620	960	1460	2160					
230	1/3	550	880	1390	2190	3400	5250	7960						
	1/2	400	650	1020	1610	2510	3880	5880						
	3/4	300	480	760	1200	1870	2890	4370	6470					
	1	250	400	630	990	1540	2380	3610	5360	6520				
	1-1/2	190	310	480	770	1200	1870	2850	4280	5240				
	2	150	250	390	620	970	1530	2360	3620	4480				
	3	120	190	300	470	750	1190	1850	2890	3610				
	5			180	280	450	710	1110	1740	2170				
	7-1/2				200	310	490	750	1140	1410				
	10					250	390	600	930	1160				

CAUTION: Use of wire size smaller than listed will void warranty.

FOOTNOTES:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length of assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

Technical Data

Three-Phase Motor Maximum Cable Length (Motor to service entrance) (2)

VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300
208	1-1/2	310	500	790	1260									
	2	240	390	610	970	1520								
	3	180	290	470	740	1160	1810							
	5		170	280	440	690	1080	1660						
	7-1/2			200	310	490	770	1180	1770					
	10				230	370	570	880	1330	1640				
	15					250	390	600	910	1110	1340			
	20						300	460	700	860	1050	1270		
	25							370	570	700	840	1030	1170	
	30							310	470	580	700	850	970	1110
230	1-1/2	360	580	920	1450									
	2	280	450	700	1110	1740								
	3	210	340	540	860	1340	2080							
	5		200	320	510	800	1240	1900						
	7-1/2			230	360	570	890	1350	2030					
	10				270	420	660	1010	1520	1870				
	15					290	450	690	1040	1280	1540			
	20						350	530	810	990	1200	1450		
	25						280	430	650	800	970	1170	1340	
	30							350	540	660	800	970	1110	1270
460	1-1/2	1700												
	2	1300	2070											
	3	1000	1600	2520										
	5	590	950	1500	2360									
	7-1/2	420	680	1070	1690	2640								
	10	310	500	790	1250	1960	3050							
	15			540	850	1340	2090	3200						
	20			410	650	1030	1610	2470	3730					
	25				530	830	1300	1990	3010	3700				
	30				430	680	1070	1640	2490	3060	3700			
	40						790	1210	1830	2250	2710	3290		
	50						640	980	1480	1810	2190	2650	3010	
	60							830	1250	1540	1850	2240	2540	2890
	75								1030	1260	1520	1850	2100	2400
	100									940	1130	1380	1560	1790
	125											1080	1220	1390
	150												1050	1190
	200												1080	1300
	250													1080
575	1-1/2	2620												
	2	2030												
	3	1580	2530											
	5	920	1480	2330										
	7-1/2	660	1060	1680	2650									
	10	490	780	1240	1950									
	15		530	850	1340	2090								
	20			650	1030	1610	2520							
	25			520	830	1300	2030	3110						
	30				680	1070	1670	2560	3880					
	40					790	1240	1900	2860	3510				
	50						1000	1540	2310	2840	3420			
	60						850	1300	1960	2400	2890	3500		
	75							1060	1600	1970	2380	2890	3290	
	100								1190	1460	1770	2150	2440	2790

CAUTION: Use of wire size smaller than listed will void warranty. FOOTNOTES: 1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size. 2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length of assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length. 3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

Technical Data

Electrical Data

Submersible Pump Motors - 60Hz

GRUNDFOS MOTORS

HP	PH	VOLT	S.F.	CIR. BRKR OR FUSES		AMPERAGE		FULL LOAD EFF. PWR		MAX. THRUST (LBS)	NAMEPLATE NO.	GRUNDFOS PRODUCT NO.
				STD.	DELAY	START	MAX.	(%)	FACT.			

4-Inch, Single Phase, 2-Wire Motors (control box not required)

1/3	1	230	1.75	15	5	25.7	4.6	59	77	750	79952101	791595016
1/2	1	230	1.60	15	7	34.5	6.0	62	76	750	79952102	791595026
3/4	1	230	1.50	20	9	40.5	8.4	62	75	750	79952103	791595036
1	1	230	1.40	25	12	48.4	9.8	63	82	750	79952104	791595046
1-1/2	1	230	1.30	35	15	62.0	13.1	64	85	750	79952105	791595056

4-Inch, Single Phase, 3-Wire Motors

1/3	1	230	1.75	15	5	14.0	4.6	59	77	750	79453101	791545016
1/2	1	230	1.60	15	7	21.5	6.0	62	76	750	79453102	791545026
3/4	1	230	1.50	20	9	31.4	8.4	62	75	750	79453103	791545036
1	1	230	1.40	25	12	37.0	9.8	63	82	750	79453104	791545046
1-1/2	1	230	1.30	35	15	45.9	11.6	69	89	750	79453105	791545056

4-Inch, Three Phase, 3-Wire Motors

1-1/2	3	230	1.30	15	8	40.3	7.3	75	72	750	79302005	791530056
		460	1.30	10	4	20.1	3.7	75	72	750	79362005	791536056
		575	1.30	10	4	16.1	2.9	75	72	750	79392005	791539056
2	3	230	1.25	20	10	48	8.7	76	75	750	79302006	791530066
		460	1.25	10	5	24	4.4	76	75	750	79362006	791536066
		575	1.25	10	4	19.2	3.5	76	75	750	79392006	791539066
3	3	230	1.15	30	15	56	12.2	77	75	1000	79304507	96405801
		460	1.15	15	7	28	6.1	77	75	1000	79354507	96405810
		575	1.15	15	6	22	4.8	77	75	1000	79394507	96405815
5	3	230	1.15	40	25	108	19.8	80	82	1000	79304509	96405802
		460	1.15	20	12	54	9.9	80	82	1000	79354509	96405811
		575	1.15	15	9	54	7.9	80	82	1000	79394509	96405816
7-1/2	3	230	1.15	60	30	130	25.0	81	82	1000	79305511	96405805
		460	1.15	35	15	67	13.2	81	82	1000	79355511	96405814
		575	1.15	30	15	67	10.6	81	82	1000	79395511	96405819

6-Inch, Three Phase, 3-Wire Motors

7-1/2	3	230	1.15	60	35	119	26.4	80.5	76	1000	78305511	96405781
		460	1.15	30	15	59	13.2	80.5	76	1000	78355511	96405794
10	3	230	1.15	80	45	156	34.0	82.5	79	1000	78305512	96405782
		460	1.15	40	20	78	17.0	82	79	1000	78355512	96405795
15	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	60	30	115	24.5	82.5	82	440	78355514	96405796
20	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	80	40	172	33.0	84	82	4400	78355516	96405797
25	3	460	1.15	100	50	217	41.0	84.5	80	4400	78355517	96405798
30	3	460	1.15	110	60	237	46.5	85	83	4400	78355518	96405799
40	3	460	1.15	150	80	320	64.0	85	82	4400	78355520	96405800

Technical Data

HITACHI MOTORS

6 Inch (Three Wire) Motors

60 HZ

HP	PH	Volts	Service Factor	Circuit Breaker or Standard Fuse	Dual Element Fuse	AMPERAGE			FULLLOAD		Line-to-Line Resistance (Ohms)		KVA Code ***	Three-Phase Overload Protection		Maximum Thrust (lbs.)	GRUNDFOS PART NO.
						Full Load	Locked Rotor	S.F. Amps	Eff.	Power Factor	Blk-Yel	Red-Yel		Starter Size	Furnas Amb. Comp		
5	1	230	1.15	80	35	23.8	124	27.1	74.8	91.2	0.51	2.2	G	-	-	1500	82.4119H
	3	230	1.15	45	20	14.8	110	16.4	76.8	82.5	0.81		K	1	K58	1500	82.9915H3
	3	460	1.15	25	10	7.4	55	8.2	76.8	82.5	3.05		K	1	K43	1500	82.9915H6
7-1/2	1	230	1.15	125	45	35.2	167	40.9	72.9	94.9	0.40	1.40	F	-	-	1500	82.4121H
	3	230	1.15	70	30	21.8	144	24.4	78.5	81.8	0.65		J	1	K64	1500	82.9116H3
	3	460	1.15	35	15	10.9	72	12.2	78.5	81.8	2.43		J	1	K54	1500	82.9916H65
10	1	230	1.15	175	60	48.0	202	54.0	73.6	93.2	0.32	1.05	#	-	-	3500	82.4123H
	3	230	1.15	80	40	28.2	208	32.0	79.3	82.8	0.45		K	1.75	K68	3500	82.9117H3
	3	460	1.15	40	20	14.3	104	16.0	79.3	82.8	1.62		K	1	K58	3500	82.9117H6
15	1	230	1.15	250	100	70.8	275	84.9	73.7	93.2	0.23	0.68	D	-	-	3500	82.9118H3
	3	230	1.15	125	60	41.4	320	46.2	81.7	83.2	0.31		K	2	K74	3500	82.9118H6
	3	460	1.15	60	30	20.7	160	23.1	81.7	83.2	1.07		K	1.75	K63	3500	82.9118H6
20	3	230	1.15	175	70	53.0	392	63.0	83.2	84.9	0.26		K	2.5	K77	3500	82.9119H3
	3	460	1.15	90	35	26.5	196	30.0	83.2	84.9	0.86		K	2	K67	3500	82.9119H6
25	3	230	1.15	200	90	67.2	530	75.4	83.0	83.9	0.21		K	3	K83	3500	82.9120H3
	3	460	1.15	100	45	33.6	265	37.7	83.0	83.9	0.67		K	2	K72	3500	82.9120H6
30	3	230	1.15	250	110	80.8	610	90.6	82.5	84.3	0.16		K	3	K86	3500	82.9121H3
	3	460	1.15	125	50	40.4	305	45.3	82.5	84.3	0.55		K	2.5	K74	3500	82.9121H6
40	3	460	1.15	150	70	51.7	340	58.8	84.0	86.3	0.46		H	3	K76	5000	82.3228H
50	3	460	1.15	200	90	69.7	465	78.8	82.5	81.4	0.39		J	3	K83	5000	82.3229H
60	3	460	1.15	225	100	80.8	465	92.8	82.4	84.4	0.39		G	3.5	K86	5000	82.3230H

8 Inch Motors

40	3	460	1.15	150	70	54.3	380	60.9	83.9	82.1	0.37		J	3	K76	10,000	82.3270H
50	3	460	1.15	200	90	64.9	435	73.6	84.1	85.7	0.33		H	3	K78	10,000	82.3271H
60	3	460	1.15	225	100	77.8	510	88.5	84.7	85.3	0.28		H	3.5	K86	10,000	82.3272H
75	3	460	1.15	350	150	96.7	650	110	84.9	85.9	0.22		H	3.5	K88	10,000	82.3274H
100	3	460	1.15	400	175	127	795	145	85.2	86.6	0.16		H	4	K89	10,000	82.3275H
125	3	460	1.15	500	225	172.0	980	192	84.2	80.9	0.14		G	4.5	K28	10,000	82.36H042
150	3	460	1.15	600	250	187.0	1060	216	85.6	87.9	0.13		G	4.5	K29	10,000	82.36H043

10 Inch Motors

200	3	460	1.15	800	350	233.0	1260	270	87.2	92.2	0.09		F	5	K33	10,000	82.36H064
250	3	460	1.15	900	450	294.0	1500	344	86.5	92.1	0.08		E	6	K27	10,000	82.36H066

FRANKLIN MOTORS

(refer to the Franklin Submersible Motors Application Maintenance Manual)

Table F

Example: Correcting for Three-Phase Power Unbalance

Example: Check for current unbalance for a 230 volt, 3 phase, 60 Hz submersible pump motor, 18.6 full load amps.

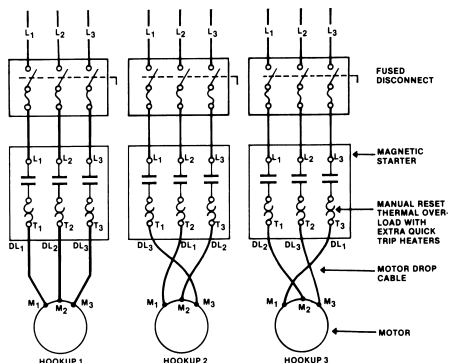
Solution: Steps 1 to 3 measure and record amps on each motor drop lead for Hookups 1, 2 and 3.

	Step 1 (Hookup 1)	Step 2 (Hookup 2)	Step 3 (Hookup 3)
(T ₁)	DL ₁ = 25.5 amps	DL ₃ = 25 amps	DL ₂ = 25.0 amps
(T ₂)	DL ₂ = 23.0 amps	DL ₁ = 24 amps	DL ₃ = 24.5 amps
(T ₃)	DL ₃ = 26.5 amps	DL ₂ = 26 amps	DL ₁ = 25.5 amps
Step 4	Total = 75 amps	Total = 75 amps	Total = 75 amps
Step 5	Average Current =	$\frac{\text{total current}}{3 \text{ readings}}$	$\frac{75}{3} = 25 \text{ amps}$
Step 6	Greatest amp difference from the average:	(Hookup 1) = 25-23 = 2 (Hookup 2) = 26-25 = 1 (Hookup 3) = 25.5-25 = .5	
Step 7	% Unbalance	(HOOKUP 1) = $\frac{2}{25} \times 100 = 8$ (HOOKUP 2) = $\frac{1}{25} \times 100 = 4$ (HOOKUP 3) = $\frac{.5}{25} \times 100 = 2$	

As can be seen, Hookup 3 should be used since it shows the least amount of current unbalance. Therefore, the motor will operate at maximum efficiency and reliability.

By comparing the current values recorded on each leg, you will note the highest value was always on the same leg, L₃. This indicates the unbalance is in the power source. If the high current values were on a different leg each time the leads were changed, the unbalance would be caused by the motor or a poor connection.

If the current is greater than 5%, contact your power company for help.



*For a detailed explanation of three-phase balance procedures, see Three-Phase Motor, section 2, page 6.

Technical Data

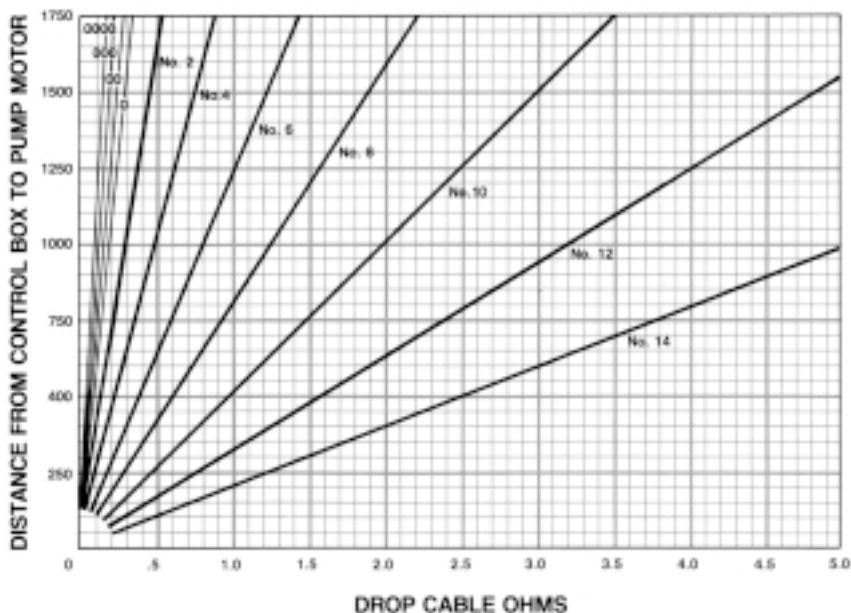
Table G

Total Resistance of Drop Cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the control box to the motor and back.

To determine the resistance:

1. Disconnect the drop cable leads from the control box or panel.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table E.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.



SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.19 Truckfill Pump – Megga

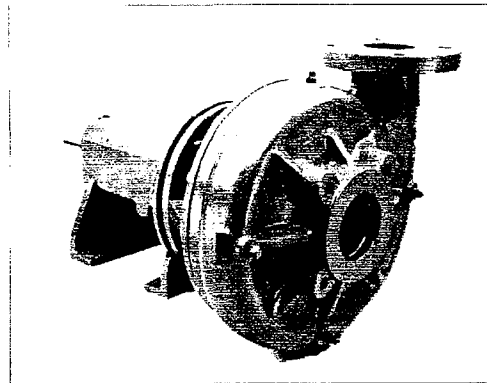
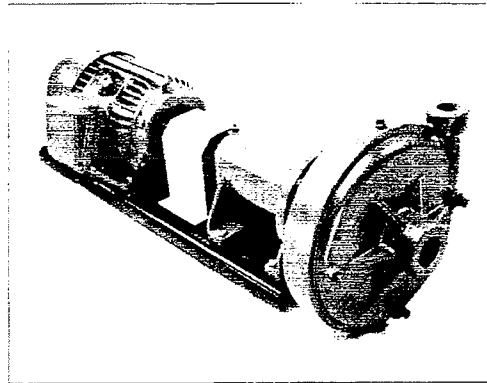
Model # Megga PCF 3L

Tag # P-315

SERIES PC

ProSpec
TECHNOLOGIES INC.

ProSpec Series PC offers heavy-duty cast construction in an economical and versatile pump. Produced in most of the stable alloys, *ProSpec Series PC* features threaded and flanged ports, industry-standard shaft seals and either frame-mounted or close-coupled configurations. *ProSpec Series PC*, affordable and heavy duty.

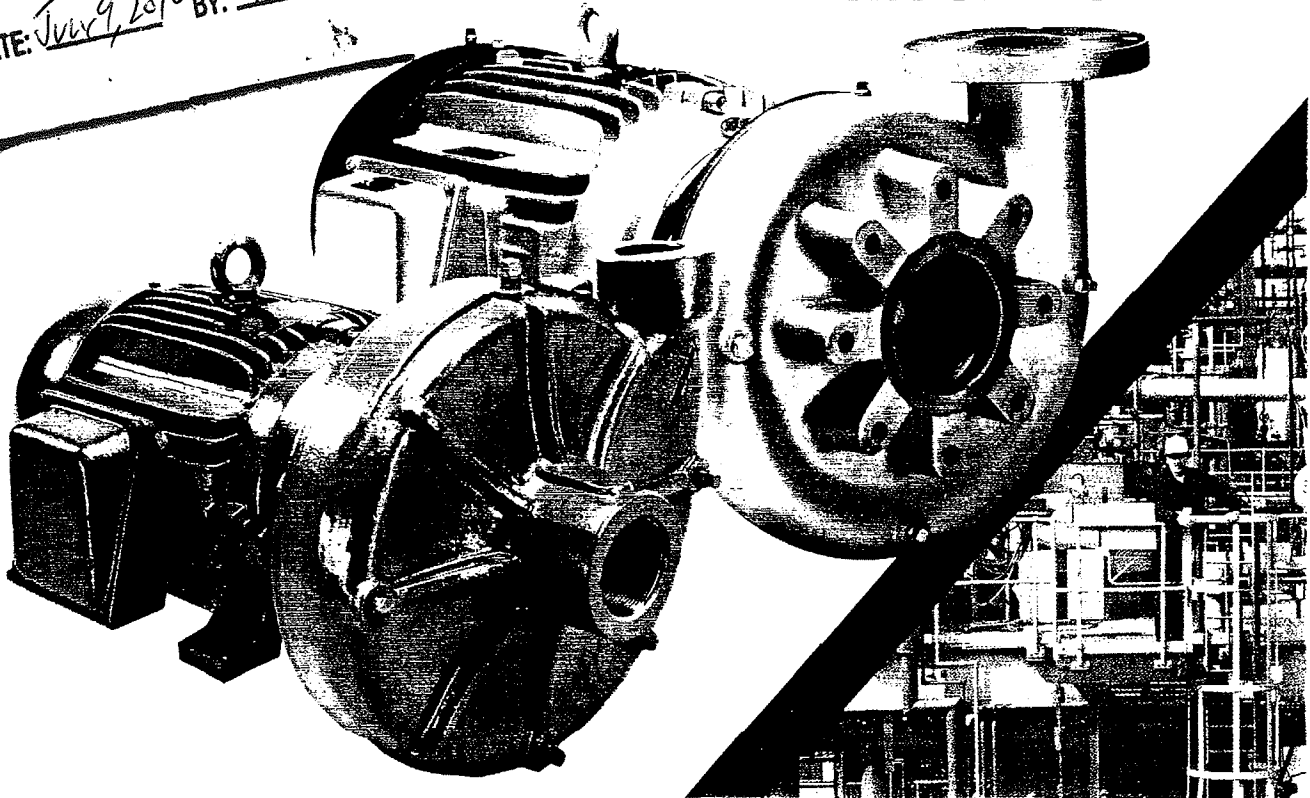


MANUAL

REVIEWED: _____
REQUIREMENTS OF THE GENERAL AND VERIFI-
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THE
REQUIREMENTS.

- ☒ REVIEWED
- ☐ MAKE NOTED CORRECTIONS
- ☐ REVISE & RESUBMIT

DATE: July 9, 2010 BY: K.B.



SERIES PC

CENTRIFUGAL PUMPS

ProSpec Series PC centrifugal pumps are a heavy-duty, single-stage, end-suction design and are available in all-iron, bronze-fitted and stainless steel construction. In addition to our standard materials, this product can be produced in other materials such as special bronze alloys, duplex stainless steels and monel. *Series PC* is available in close-coupled and frame-mounted configurations with threaded (model PCT) and flanged (model PCF) connections. Utilizing industry-standard, mechanical-type shaft seals and standard motors, *Series PC* is the answer to today's tough services and economic demands.

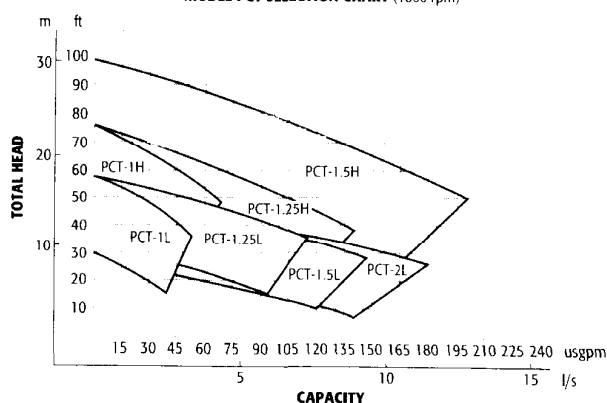
FEATURES AND BENEFITS

- Heavy-duty cast construction and high quality materials and workmanship ensure long, dependable service life.
- Close-coupled and frame-mounted configurations for maximum installation and operating flexibility.
- Popular back pull-out design allows for quick and easy maintenance.
- Tangential discharge on most models provides higher volume efficiencies and installation flexibility.
- Fully enclosed cast impellers are inherently efficient and robust in design for lower energy use and long life.
- Industry-standard mechanical seals and motors ensure easy aftermarket replacements and modifications.

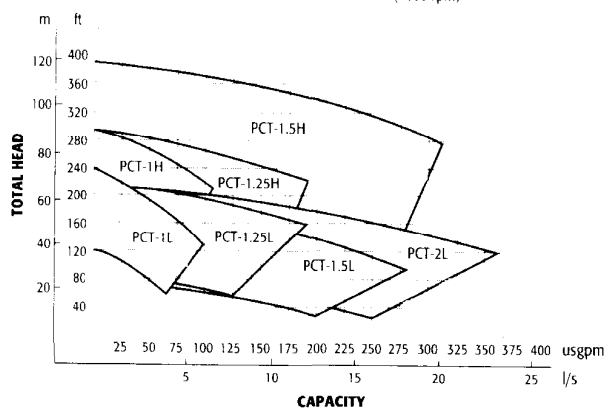
TYPICAL APPLICATIONS

- Water treatment
- Brine transfer
- Chemical transfer
- Washing systems
- Bottling/filling services
- Irrigation
- Waste water
- Oils
- Machine tool coolants
- Sanitizing systems
- Seawater
- Heating and cooling

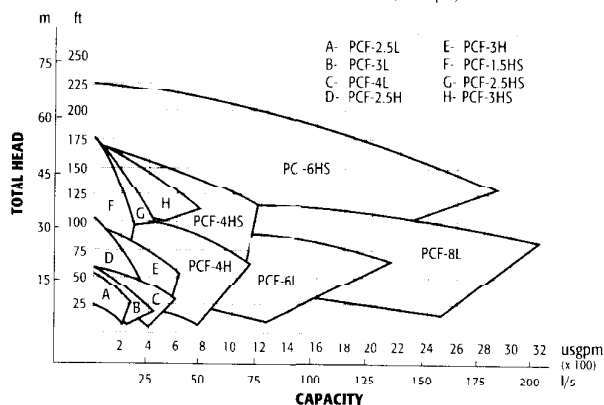
MODEL PCT SELECTION CHART (1800 rpm)



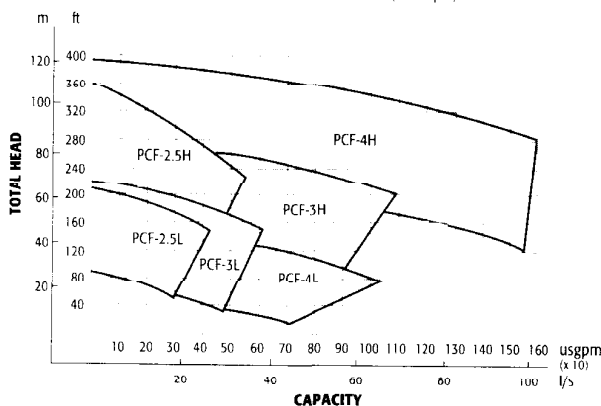
MODEL PCT SELECTION CHART (3600 rpm)



MODEL PCF SELECTION CHART (1800 rpm)



MODEL PCF SELECTION CHART (3600 rpm)



ProSpec
TECHNOLOGIES INC.

Bulletin PC100A

**INSTALLATION
OPERATING AND MAINTENANCE
MANUAL**

**Series PC
Frame Mounted Centrifugal Pumps**

Model PCT & PCF

Receipt of Shipment

INSPECTION: On receipt of the pump set in its shipping container, carefully check for damage. Check the contents against the shipping manifest and report any shortages or damage immediately to the carrier. This will prevent any conflict with the carrier in the event a claim is required.

UNLOADING: Handle the unit with care when removing it from its shipping crate. Lift the equipment with suitable slings through the pump frame and motor lifting eye bolt. **Do not** sling around motor or pump shaft. On base mounted units it is recommended to lift assembly by slinging through eyebolts mounted to the baseplate foundation holes.

Do not sling around the pump or motor shafts or on the coupling assembly.

STORAGE: Adequate methods of storage are essential to ensure that the pump does not suffer damage from moisture, dust or damage from careless handling. Any deterioration or damage from inadequate storage will not be covered under warranty. If the equipment is not going into service, long term storage procedures should be followed.

Installation

LOCATION: Locate the pump in an accessible place so that it can be inspected during operation. Place the pump as close to the liquid supply as possible. Provide ample head room and facilities for installation and removal.

The pump area should be safeguarded against flooding.

FOUNDATION: Baseplate mounted pumps are normally grouted on a concrete foundation which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit. Sleeved or "J" bolt foundation anchors are recommended for baseplate mounting. (See Fig.1)

On Installations where the pump is to be mounted on a steel skid, it is recommended to through bolt sub base to structure using vibration dampeners between the base and steel structure. Do not weld the baseplate as this results in greater vibration and noise.

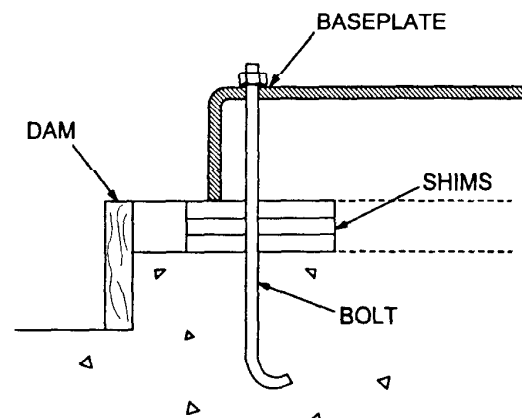


Fig. 1

LEVELING: The baseplate should be supported on leveling wedges or shims placed on each side and as close to the foundation bolts as possible. Check the setting with a level and adjust shims as necessary. The wedges or shims should be placed 24" apart around the base. A gap of $\frac{3}{4}$ " to 1-1/2" should be allowed between the baseplate and foundation for grouting. (See Fig.1)

GROUTING: When the leveling is correct the foundation bolts should be tightened evenly but not too firmly. Build a dam around the baseplate. The consistency of grout should be such to allow free flowing of the mixture. Follow the mixing instructions of the manufacturer. The dam should be completely filled with grout and allowed to set. At this point the baseplate should be completely filled with grout and allowed to set before finally tightening the foundation bolts. **Note; *Non grouted baseplates result in higher noise and vibration levels, which lead to reduced overall pump life.***

PIPING: It is important that the suction and discharge piping be correctly aligned to the pump. The weight of all piping and valves should be supported independent of the pump. All piping should be flushed removing any construction debris, prior to final connection to the pump.

Suction piping should be short, direct and one or two sizes larger than the pump suction. Avoid the use of short radius elbows, there should be a minimum of two pipe diameters of straight pipe between the elbow and the pump inlet. Suction reducers should be eccentric type with the sloping side mounted down. If suction strainers are required they should be sized to have a free area of at least 3 times that of the suction pipe area. On suction lift applications, the suction piping must slope upwards toward the pump suction to eliminate suction pockets, all joints must be air tight. On non-self priming pumps a means of priming the pump must be provided. On flooded suction

applications, an isolation valve should be installed to permit closing of the line for pump repairs. Piping should be level or sloping downward from source of supply, and no portion of the piping should extend below the pump suction flange.

Discharge piping should be installed with an isolation valve and check valve.

Locate the check valve between the pump and the isolation valve. If reducers are used they should be installed between the pump and check valve. Cushioning devices should be used to protect pump from surges and water hammer if quick-closing valves are installed in the system.

COUPLING ALIGNMENT: On frame mounted pumps coupling must be aligned as suggested by the coupling manufacturer. As a minimum apply the following for elastomeric type couplings.

Check parallel alignment by placing a straight edge across the coupling flange diameters and measuring the offset at various points around the coupling. Refer to recommended tolerances and shim motor as required. Check angular alignment by measuring the back side of each coupling hub at 90 Deg. Intervals. The difference between the minimum and maximum readings must be less than the misalignment allowed by the coupling manufacturer.

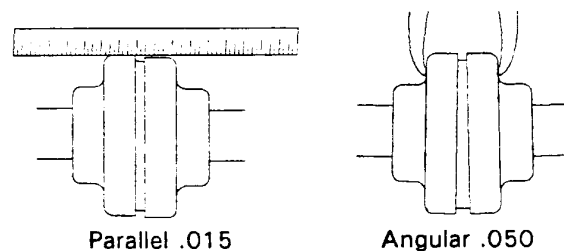


Fig 2

Operation

PRE-STARTUP CHECK : Confirm that the pump can be turned by hand before checking rotation. Verify that the rotation of the motor corresponds to the rotation arrow located on the pump. On frame mounted pumps disconnect the coupling and bump start motor, correct rotation as required and reconnect the coupling and coupling guard. **Do not** run the pump dry, see priming instructions.

PRIMING: Ensure that the pump casing and suction piping is completely filled with liquid before starting the pump. A centrifugal pump must be primed before it can operate, damage will occur to close clearance rotating parts if allowed to run dry. On flooded suction systems allow fluid into the pump and vent air from the plug located at the top of the casing. On suction lift applications adequate means must be employed to maintain fluid in the pump casing, this is usually accomplished using a suction foot valve or vacuum priming system, air must be vented through the plug located at the top of the pump casing.

STARTING: Ensure that the suction line is open, and the discharge valve is closed. Turn the starter on and off allowing the pump to rotate and coast to a stop, if the unit stops suddenly or makes any undue noise, correct the problem before proceeding. At this point bring the pump up to its rated speed and slowly open the discharge valve to permit the pump to deliver its rated flow. If there is any undue noise or vibration shut down the motor and correct the problem. After pump has

been running for some time check for bearing heat, temperatures up to 175 F are acceptable providing they are stable and do not continue to rise. **Note;** Do not operate the pump below 10% of the best efficiency point or rated minimum flow, or against a closed discharge or suction valve.

These conditions will lead to rapid pump failure and possible injury

STOPPING: Close the discharge valve, shutdown and lockout the power supply. Do not restart the pump until it comes to a complete stop.

Exposure to freezing conditions while the pump is idle may cause damage to the pump casing. In these conditions drain liquid from plug provided in bottom of pump casing. **Note;** When handling toxic or corrosive fluids, precautions must be taken to prevent injury or environmental contamination. Pumpage must be handled and disposed of in accordance with applicable environmental regulations.

OPERATION CHECKS : Inspect pump frequently during the first few hours of operation. Mechanical seals may weep slightly, but should “run-in” in a few hours of operation. Check pump bearings for excessive heat and check pump assembly for unusual noise and vibrations, correct any problems before restarting pump.

MAINTENENCE

GENERAL: The pump and motor unit should be checked at regular intervals for any slight increase in noise or bearing temperature. Consult the troubleshooting section of this manual for the most common occurring pump problems.

BEARINGS: All ball bearings are lubricated at the factory and only require regular maintenance as required by the specific application. Grease lubricated pumps will have enough lubricant for startup and initial operation of approximately 1500 hours. Oil lubricated pumps are shipped without oil and need to be filled through the filler connection located on top of the bearing housing. Oil should be a good quality non detergent bearing oil with rust and oxidation inhibitors.

REPAIR- Frame mounted pump

REMOVAL: Lock out the power supply to the motor and remove the pump assembly from the baseplate.

DISMANTLING: Refer to Cross section drawing enclosed for reference of part items specified in the instructions below;

1. Remove casing bolts #370 and pull casing #100 from adapter #108. Inspect wear ring #103 for wear, if installed.
2. Remove impeller bolt #304 and gasket ring #412A.
3. Remove impeller #101 by lightly prying between the impeller and adapter #108, on larger models a standard wheel puller may be required to remove impeller. **Note:** when prying or pulling impeller, apply loads to the back shroud of the impeller at the point that is supported by the impeller vane.
4. Inspect and replace sleeve Oring #412B.
5. Remove sleeve and mechanical seal assembly #126 and #383 from the shaft and inspect for signs of wear. The seal should always be replaced, or as a minimum be re-lapped. The shaft sleeve need only be replaced if there are signs

of wear or grooving. Note; on some models the sleeve is a shrink fit on the shaft, those models will not have impeller gasket and sleeve Oring #412A and 412B.

6. Remove #108 adapter from frame #228, once removed push mechanical seal stationary seat from machined counter bore. Replace or re-lap seat as required.

7. Remove #123 slinger and replace if required.

8. Remove rear bearing cap #134B and pull shaft with bearings out of bearing frame #228. It may be necessary to tap shaft from impeller end by using a wooden block on the impeller end of the shaft and tapping out the complete shaft assembly.

9. Oil lubricated pumps are supplied with standard lip seals #332 and #333 and are pressed into caps #134A and 134B. The lip seals should be replaced on oil lubricated pumps.

10. Remove lock nut and washer #136 and #382 and replace bearings #112 and #168. Inspect shaft for straitness and replace if bent or worn at the bearing journals.

INSPECTION: Check all O-rings and gaskets for tears, nicks or cracks and replace as required. Inspect impeller and casing wear ring if installed, for grooving or dimensional wear and replace if worn. Inspect lapped surface of seal #383 for grooving, cracking or scratches and replace if required. Check shaft run out with a dial indicator and replace bearings if required, shaft run out should not be more than .002" at the sleeve area.

ASSEMBLY: Reverse disassembly procedure noting the following:

Mechanical seal stationary seat must be installed into bore machined into item #108, lightly lubricate seal cup and press with fingers or special tool into adapter #108, making sure seat is square and all the way to the bottom of the adapter bore.

Mechanical seal rotary should be installed on sleeve #126 by lightly lubricating the sleeve and pushing seal head over shaft sleeve. See general seal installation instructions provided by seal manufacturer.

Depending on the pump size and design the shaft sleeve #126 is lightly pressed on the shaft or is a slip fit as detailed in Fig 3 below. For the slip fit sleeve the mechanical seal must be installed on the sleeve first and then the whole assembly installed on the frame shaft.

The pressed on sleeve requires the seal to be installed after the sleeve has been installed on the shaft.

Replace O-rings and gaskets item #351, 412A and 412B and on oil lubricated pumps item #360A and 360B also.

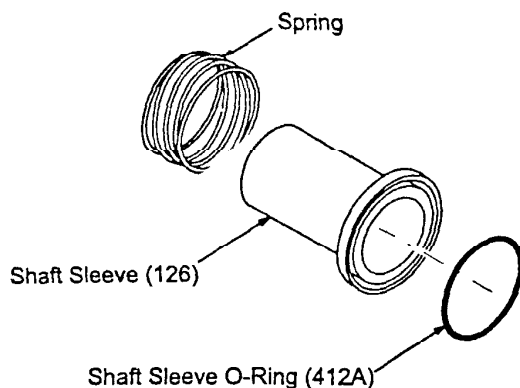


Fig. 3

Spare Parts

RECOMMENDED SPARES:

Item #	Description
# 112	Thrust Bearing
# 123	Slinger
# 126	Shaft sleeve
# 168	Radial Bearing
# 351	Casing Gasket

# 382	Bearing Lock Washer
# 383	Mechanical Seal
# 412A	O-Ring
# 412B	O-Ring

ORDERING SPARES: Spare parts can be ordered from the enclosed parts list. The pump serial number and model number should be given from the pump name plate. In the case of auxiliary equipment that may have been supplied with the pump, quote the full name plate data and describe the part fully.

Troubleshooting

INSUFFICIENT CAPACITY

1. System head is greater than design head.
2. Ensure the driver speed is correct.
3. Impeller is clogged.
4. Check that all valves and discharge line is fully open.
5. Check for correct rotation.
6. Suction lift is too high or insufficient submergence of the suction pipe.
7. Incorrect impeller diameter.
8. Excessive impeller clearance.
9. Viscosity or specific gravity is greater than that for which the pump is capable.
10. Air leaks in suction pipe system.
11. Pump is not primed.
12. Insufficient NPSH available.

Loss of suction following a period of satisfactory operation:

1. Air leaks in suction pipe system.
2. Mechanical seal failure, causing pump to lose prime.
3. Suction lift too high or insufficient NPSH available.
4. Entrained air or gas in pumped fluid.
5. Defective casing or flange gasket.
6. Clogged suction strainer.

PUMP OVERLOADS DRIVER

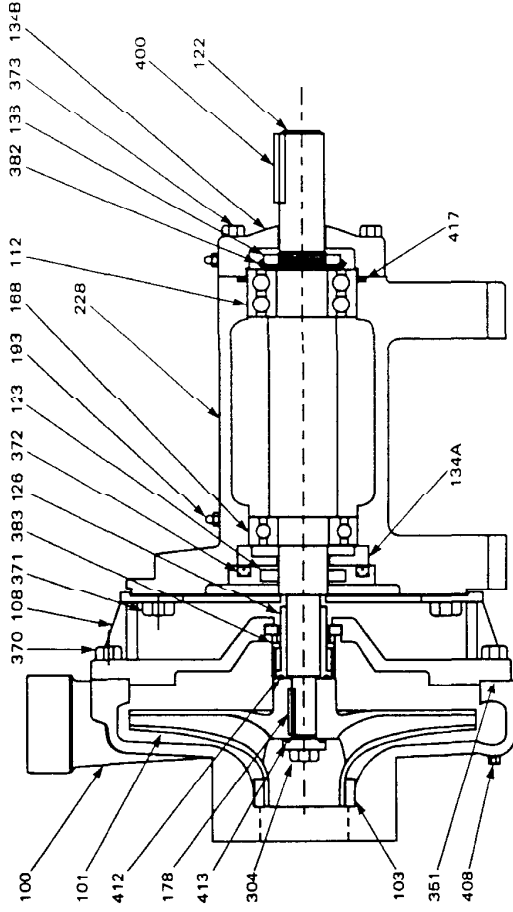
1. Driver speed too high for pump design.
2. System head is too low and pump is delivering too much flow.
3. Fluid is of greater viscosity or specific gravity than the pump was sized for.
4. Binding or rubbing of the rotation element. Check for impeller rub, faulty bearings or bent shaft.
5. Impeller may be oversized. Check with supplier before taking corrective action.

EXCESSIVE VIBRATION

1. Insufficient submergence of suction.
2. Impeller clogged or out of balance.
3. Worn out bearings.
4. Bent shaft.
5. Misalignment of pump assembly.
6. Foundation is not sufficiently rigid.
7. Insufficient NPSH available.

SERIES PC Cross Section

MODEL PCT frame mounted

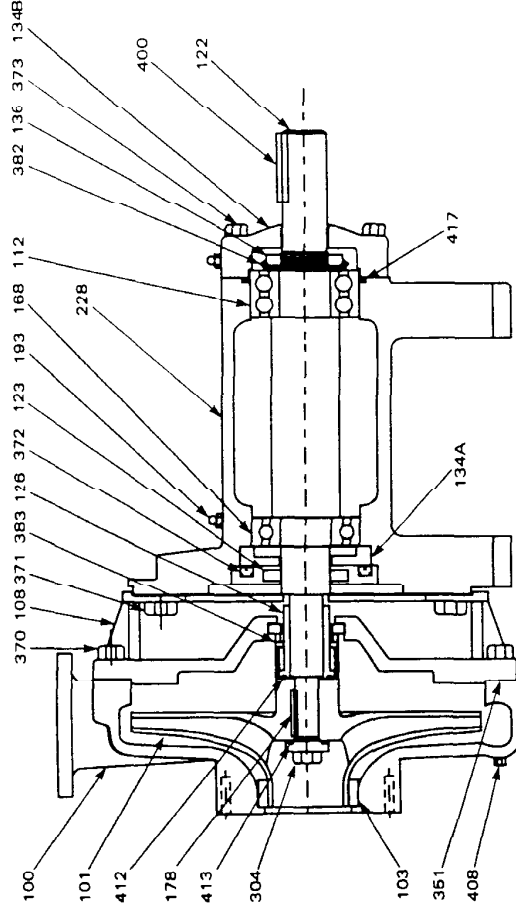


ITEM	QTY REQ'D	DESCRIPTION	MATERIAL					
			All Iron	Brz. Fitted	All Bronze	316 Fitted	All 316 SS	
100	1	Casing	Cast Iron	Cast Iron	Bronze	Cast Iron	316 SS	316 SS
101	1	Impeller	Cast Iron	Bronze	Bronze	316 SS	316 SS	316 SS
103	1	Casing wear ring	Cast Iron	Bronze	Bronze	316 SS	316 SS	316 SS
108	1	Adapter	Cast Iron	Cast Iron	Cast Iron	Cast Iron	316 SS	316 SS
112	1	Thrust bearing	Steel	Steel	Steel	Steel	Steel	Steel
122	1	Shaft	Steel	Steel	Steel	Steel	Steel	Steel
123	1	Slinger	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber
126	1	Shaft sleeve	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS
134A	1	Inboard brg cap	Steel	Steel	Steel	Steel	Steel	Steel
134B	1	Outboard brg cap	Steel	Steel	Steel	Steel	Steel	Steel
136	1	Brg lock nut	Steel	Steel	Steel	Steel	Steel	Steel
168	1	Radial bearing	Steel	Steel	Steel	Steel	Steel	Steel
178	1	Impeller key	Steel	Steel	Steel	Steel	Steel	Steel
193	2	Grease fitting	Steel	Steel	Steel	Steel	Steel	Steel
228	1	Bearing frame	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron
304	1	Impeller bolt	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS
361	1	Casing gasket	Paper fibre	Paper fibre	Paper fibre	Paper fibre	Paper fibre	Teflon
370	*	Casing bolt	Steel	Steel	Steel	Steel	Steel	316 SS
371	4	Frame bolt	Steel	Steel	Steel	Steel	Steel	Steel
372	4	Inboard cap bolt	Steel	Steel	Steel	Steel	Steel	Steel
373	4	Outboard cap bolt	Steel	Steel	Steel	Steel	Steel	Steel
382	1	Brg lock washer	Steel	Steel	Steel	Steel	Steel	Steel
383	1	Mechanical seal	Various	Various	Various	Various	Various	Various
400	1	Shaft key	Steel	Steel	Steel	Steel	Steel	Steel
408	4	Casing plug	Cast Iron	Cast Iron	Bronze	Cast Iron	316 SS	316 SS
412	1	Sleeve gasket	Buna	Buna	Buna	Buna	Buna	Buna
413	1	Impeller gasket	Teflon	Teflon	Teflon	Teflon	Teflon	Teflon
417	1	Retaining ring	Steel	Steel	Steel	Steel	Steel	Steel

* Dependent on pump model

SERIES PC Cross Section

MODEL PCF frame mounted



ITEM	QTY REQ'D	DESCRIPTION	MATERIAL				
			All Iron	Brz. Fitted	All Bronze	316 Fitted	All 316 SS
100	1	Casing	Cast Iron	Cast Iron	Bronze	Cast Iron	316 SS
101	1	Impeller	Cast Iron	Bronze	Bronze	316 SS	316 SS
103	1	Casing wear ring	Cast Iron	Bronze	Bronze	316 SS	316 SS
108	1	Adapter	Cast Iron	Cast Iron	Cast Iron	Cast Iron	316 SS
112	1	Thrust bearing	Steel	Steel	Steel	Steel	Steel
122	1	Shaft	Steel	Steel	Steel	Steel	Steel
123	1	Slinger	Rubber	Rubber	Rubber	Rubber	Rubber
126	1	Shaft sleeve	316 SS	316 SS	316 SS	316 SS	316 SS
134A	1	Inboard brg cap	Steel	Steel	Steel	Steel	Steel
134B	1	Outboard brg cap	Steel	Steel	Steel	Steel	Steel
136	1	Brg lock nut	Steel	Steel	Steel	Steel	Steel
168	1	Radial bearing	Steel	Steel	Steel	Steel	Steel
178	1	Impeller key	Steel	Steel	Steel	Steel	Steel
193	2	Grease fitting	Steel	Steel	Steel	Steel	Steel
228	1	Bearing frame	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron
304	1	Impeller bolt	316 SS	316 SS	316 SS	316 SS	316 SS
351	1	Casing gasket	Paper fibre	Paper fibre	Paper fibre	Paper fibre	Teflon
370	•	Casing bolt	Steel	Steel	Steel	Steel	316 SS
371	4	Frame bolt	Steel	Steel	Steel	Steel	Steel
372	4	Inboard cap bolt	Steel	Steel	Steel	Steel	Steel
373	4	Outboard cap bolt	Steel	Steel	Steel	Steel	Steel
382	1	Brg lock washer	Steel	Steel	Steel	Steel	Steel
383	1	Mechanical seal	Various	Various	Various	Various	Various
400	1	Shaft key	Steel	Steel	Steel	Steel	Steel
408	4	Casing plug	Cast Iron	Cast Iron	Bronze	Cast Iron	316 SS
412	1	Sleeve gasket	Buna	Buna	Buna	Buna	Buna
413	1	Impeller gasket	Teflon	Teflon	Teflon	Teflon	Teflon
417	1	Retaining ring	Steel	Steel	Steel	Steel	Steel

* Dependent on pump model

TROUBLESHOOTING

Troubleshooting Pump		
Problem/Malfunction	Probable Cause	Remedy
No Liquid Delivered	Pump not primed.	Reprime pump, check that pump and suction line are full of liquid.
	Suction lift too high.	Shorten suction pipe.
	Suction line clogged.	Check suction line pressure. If low, locate and remove obstruction.
	Foot valve or suction pipe opening not submerged enough.	Consult factory for proper depth. Use baffle to eliminate vortices.
	Impeller clogged with foreign material.	Disassemble and remove blockage.
Pump not producing rated flow or head	Air leak in suction line.	Check for leakage and correct.
	Impeller partly clogged.	Backflush pump to clean impeller.
	Insufficient suction head.	Ensure that suction line shutoff valve is fully open and line is unobstructed. Check suction pressure.
	Wrong rotation.	Correct wiring.
	Worn or broken impeller.	Inspect and replace if necessary.
Pump starts then stops pumping	Improperly primed pump.	Reprime pump.
	Air or vapor pockets in suction line.	Rearrange piping as necessary to eliminate air pockets.
	Air leak in suction line.	Check for leakage and correct.
Pump is noisy or vibrates	Partly clogged impeller causing imbalance.	Disassemble and remove blockage.
	Worn motor bearings.	Replace defective part as required.
	Base not rigid enough.	Tighten hold down bolts of pump and motor or adjust stilts. Check grout.
	Suction or discharge piping not anchored or properly supported.	Anchor per Hydraulic Institute Standards recommendations (Edition 14, Centrifugal pump section).
	Pump is cavitating.	Increase NPSH available.
Motor requires excessive power	Head lower than rating; pumps too much liquid.	Install throttle valve.
	Liquid heavier than expected.	Check specific gravity and viscosity.
	Head higher than rating, capacity at rating.	Check impeller diameter.
	Wrong rotation.	Correct wiring.
	Rotating parts binding or severely worn.	Check internal wearing parts for proper clearances.

General Instructions:

Before installing seal carefully study the engineering layout.

The JOHN CRANE Shaft Seal is a precision product. Treat it with care. In handling, do not let the carbon sealing washer drop or fall; and take particular care not to scratch the lapped faces on the washer and floating seat.

If the seal has been used before, do not put it back in service until the sealing faces of the carbon washer and seat have either been relapped or replaced.

Save cardboard shipping ring between lapped surfaces of seal. (See point No. 5 below)

Installing The Seal Seat

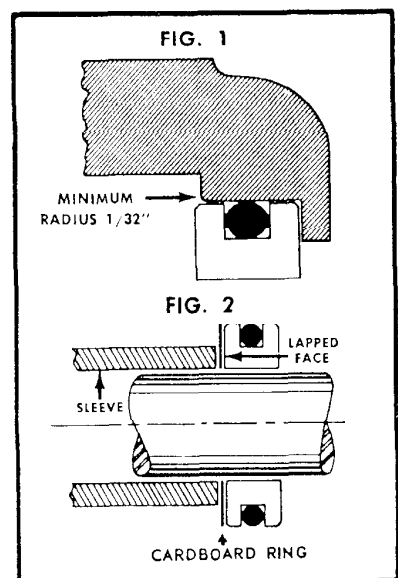
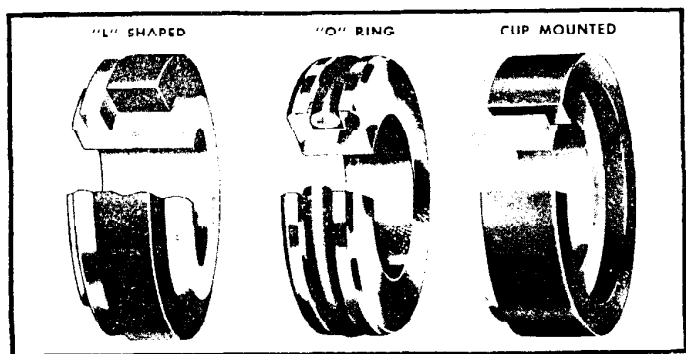
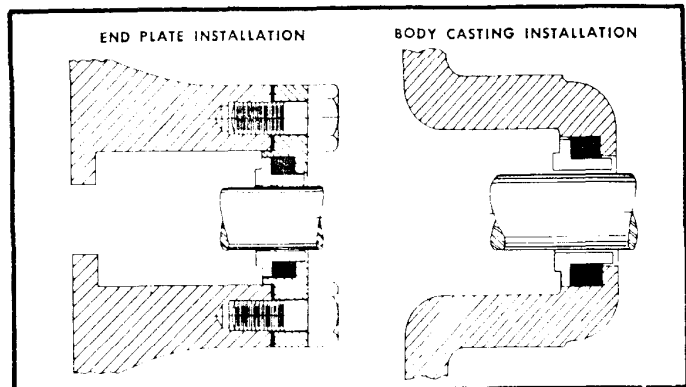
1. There are two locations where seal seats are generally installed (a) in the end plate or (b) in cavity in the body casting of the equipment (See illustrations at right).
2. One of three different types of seats may be furnished for your particular installation; the "L" shaped type, the "O" ring type or the cup mounted type (see illustration at right). The "L" shaped seat has a rectangular rubber ring, the "O" ring style utilizes an "O" ring in a confined groove and the cup mounted type employs an "L" shaped molded rubber ring over a square seat.

NOTE: If "L" shaped seat is installed, make sure that the rubber ring is right against the shoulder of the seat with the rounded edge at the rear.

3. See that there is a 1/32" minimum radius (do not chamfer) on the edge of the housing cavity which holds the seat and seat ring.
4. Oil the outer surface of the seat ring (use light oil, not grease) and push the assembly into the cavity, seating it firmly and squarely.
5. If it is not possible to insert seat with the fingers, place cardboard protecting ring furnished with seal over face of seat and press into bore with piece of tubing having end cut square. Tubing should be only slightly larger than diameter of shaft. Remove cardboard ring after seat is firmly seated (See Fig. 2 at right).

Cleaning Seal Faces

Before completing the Shaft Seal installation, wipe the lapped sealing faces of the seat and sealing washer perfectly clean.

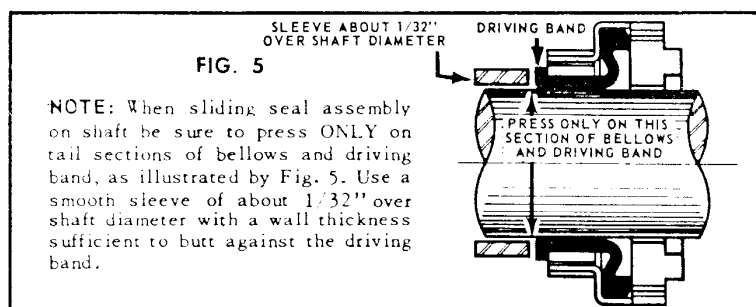
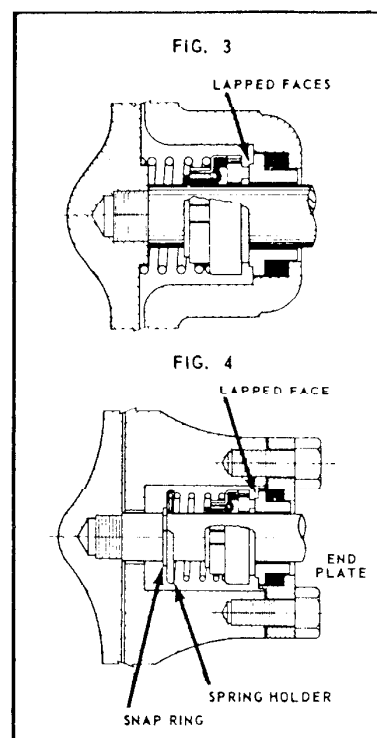


Installing Single Type 21 Seal

1. Install seat as described on opposite page and clean lapped faces.
2. Clean, polish and oil shaft or sleeve over which seal will pass; and make sure there is a $1/32$ " minimum radius on leading edge, also make certain that all edges of any keyways or snap ring grooves are smooth and broken. Clean and oil lapped sealing faces using clean light oil (not grease).
3. When seat is installed in body casing (See Fig. 3) place the sealing washer and bellows assembly on the shaft or sleeve (but not the spring) and slide the assembly in until it meets the seat. Make sure that the notches on the edge of the sealing washer mate with the retainer lugs (See Fig. 3). In case assembly cannot be slid into position with the fingers, use sleeve and mallet as shown in Fig. 5. Install spring and make sure it is seated properly over tail of bellows. Install impeller or other holding means and check spring position again for proper seating.
4. (a) When seat is installed in end plate (See Fig. 4) put on snap ring and spring holder (when specified) and spring. Be sure that spring is centered in spring holder.

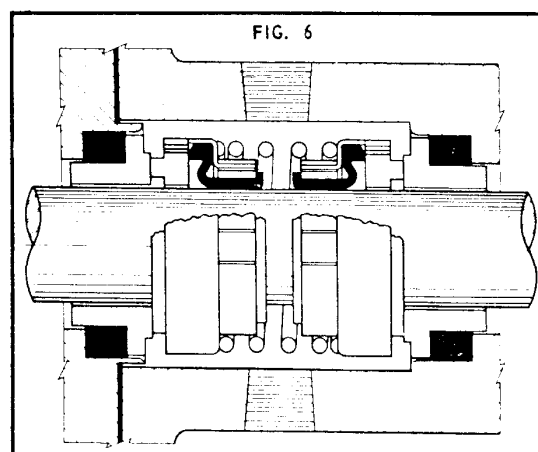
(b) Slide rubber bellows and washer assembly as a unit along shaft just far enough to center in spring and hold spring in this location. Do not compress spring at this stage.

(c) After installing seat as described on opposite page and before putting end plate over shaft, thoroughly clean and oil both lapped faces. Then slide end plate on shaft and press it in as far as it will go. Do not allow it to spring out or move backward. Tighten screws or bolts uniformly to keep the face of the seat at right angles to shaft. Tightening of end plate automatically sets seal in proper position.
5. Make sure all by-pass connections are properly attached.
6. Bleed all air and vapor from unit prior to start and make sure there is liquid in seal housing to insure proper initial lubrication for seal faces. Never run seals dry.



Installing Double Type 21 Seal

1. Install both inboard and outboard seats and clean lapped faces.
2. Place washer and bellows inboard assembly on shaft (not spring) and slide into position against inboard seat. In case finger pressure can not be applied see Fig. 5 above.
3. Install spring into position making sure it is properly seated over tail of bellows.
4. Place washer and bellows outboard assembly on shaft and slide into a position. Make sure spring is properly seated (See Fig. 6).
5. Before putting end plate on shaft, thoroughly clean and oil lapped faces of both seal washer and seat. Then slide end plate on shaft and press it in as far as it will go. Do not allow it to spring out or move backward. Tighten screws or bolts uniformly to keep faces of the seat at right angles to shaft. Tightening of end plate automatically sets seal in proper position.

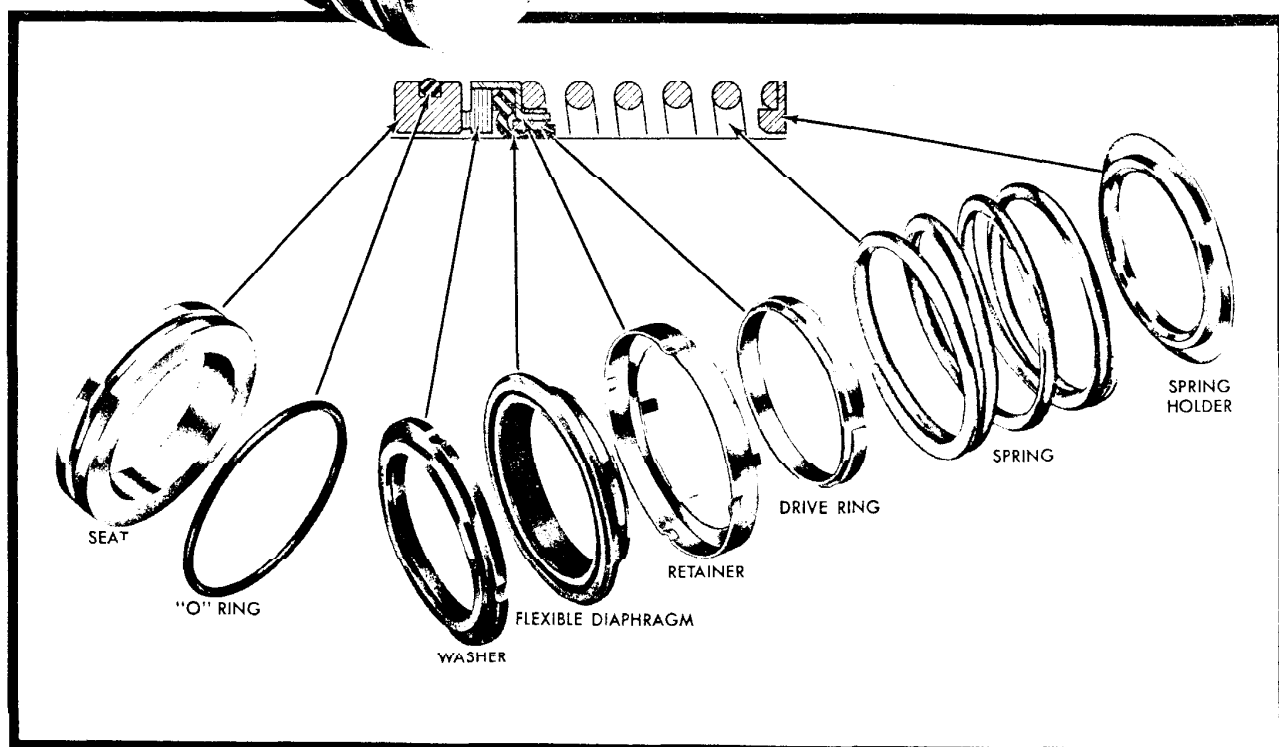
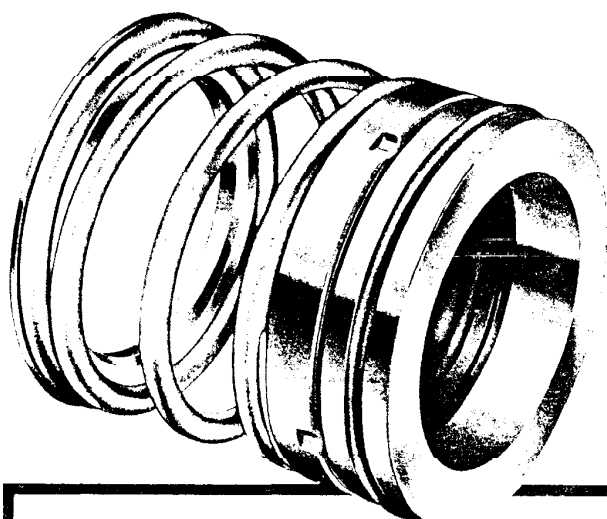


6. Make sure all auxiliary piping connections are properly attached. Check your specific layout drawing for proper seal chamber circulation instructions.

INSTALLATION INSTRUCTIONS

TYPE 21

SHAFT SEAL



Crane Packing Company Limited

GENERAL OFFICE AND FACTORY, 423 GREEN ROAD
STONEY CREEK, ONTARIO

ProSpec
TECHNOLOGIES INC.

*Pumps and
accessories*

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MISSISSAUGA, ONTARIO, CANADA L4X 2D6
PHN: (905) 629-3100 • FAX: (905) 629-3500
1-888-797-PUMP www.prospectech.com

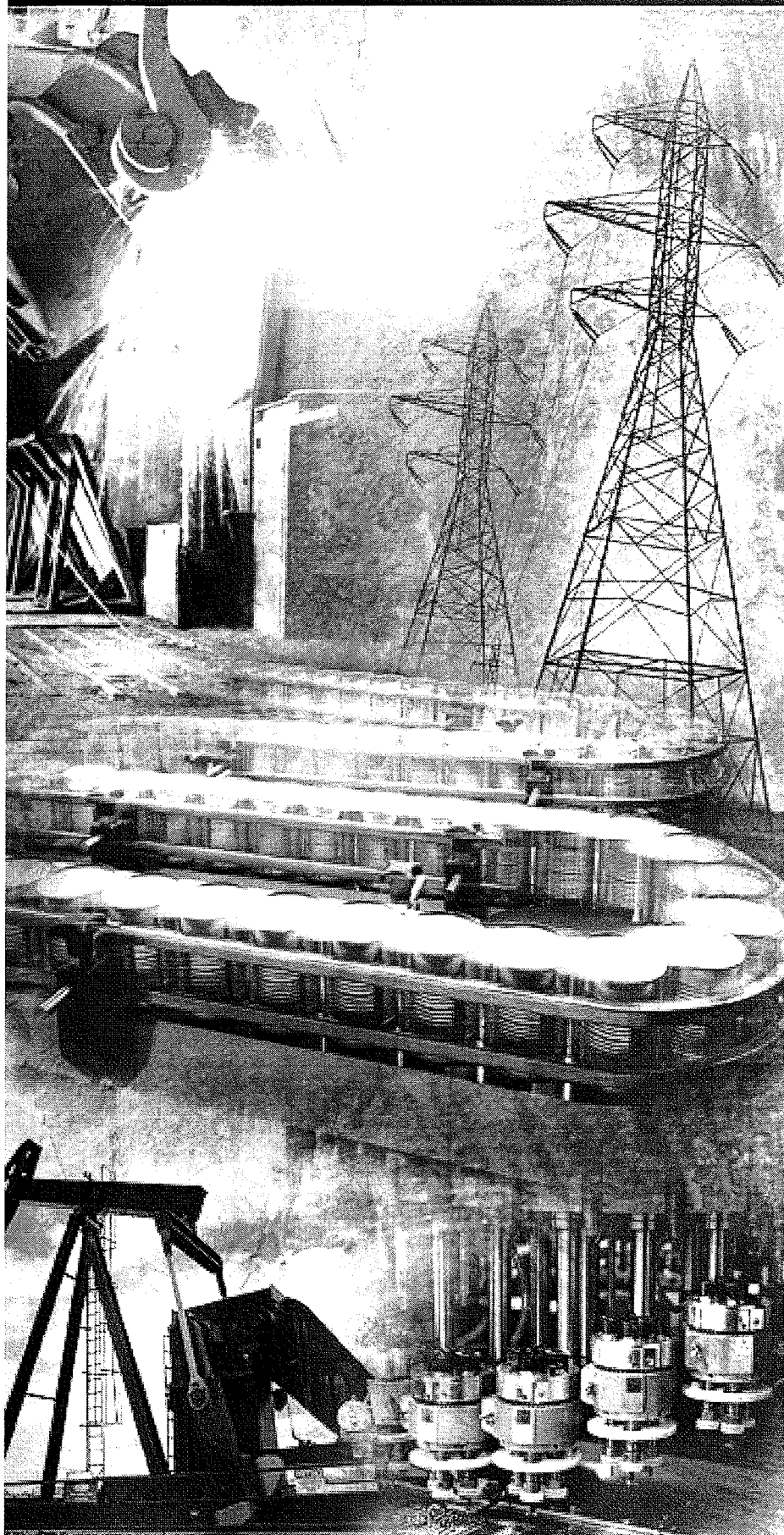
SECTION 9.3 PROCESS, INSTRUMENTATION & CONTROLS

Section 9.3 Process, Instrumentation & Controls

9.3.20 Allen Bradley Control Panel

Model # PanelView Plus 700

Tag # NA



Allen-Bradley

CompactLogix Controllers

Catalog Numbers 1769-L31,
1769-L32C, 1769-L32E, 1769-L35CR,
1769-L35E

Firmware Revision 16

REVIEWED ACCORDING TO THE
REQUIREMENTS OF THE GENERAL
CONDITIONS OF THE CONTRACT. ANY
ACTION INDICATED IS SUBJECT TO THESE
REQUIREMENTS.

☒ REVIEWED

☐ MAKE NOTED CORRECTIONS

☐ REVISE & RESUBMIT

DATE: July 9,
2010

BY: K.B.

User Manual

**Rockwell
Automation**

Important User Information

Solid state equipment operates differently than electromechanical equipment. To learn how solid state equipment differs from hard-wired electromechanical devices, consult Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls, publication SGI-1.1, available from your local Rockwell Automation sales office or online at <http://www.ab.com/literature>. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to: personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
SHOCK HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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Introduction

This release of this document contains new and updated information. To find new and updated information, look for change bars, as shown next to this paragraph.

Updated Information

The document contains these changes.

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Introduction

Use this manual to become familiar with the CompactLogix controller and its features. This manual corresponds to controller firmware revision 16.

This manual describes the necessary tasks to install, configure, program, and operate a CompactLogix system. In some cases, this manual includes references to additional documentation that provides the more comprehensive details.

Additional Information

These documents address Logix5000 products.

Catalog Number	Title	Publication Number
1769-L31, 1769-L32E, 1769-L35CR, and 1769-L35E	Logix5000 Controllers Quick Start	1756-QS001
1769-L31, 1769-L32C, 1769-L32E, 1769-L35CR, and 1769-L35E	Logix5000 Controllers Common Procedures Programming Manual	1756-PM001
	SFC and ST Programming Languages Programming Manual	1756-PM003
	Logix5000 Controllers System Reference	1756-QR107
	Logix5000 Controllers General Instruction Set Reference Manual	1756-RM003
	Logix5000 Controllers Process Control/Drives Instruction Set Reference Manual	1756-RM006
	Logix5000 Controllers PhaseManager User Manual	LOGIX-UM001
1769-L32E and 1769-L35E	EtherNet/IP Communication Modules in Logix5000 Control Systems User Manual	ENET-UM001
1769-L32C and 1769-L35CR	ControlNet Communication Modules in Logix5000 Control Systems User Manual	CNET-UM001

To view or download these publications, go to:

<http://literature.rockwellautomation.com>

To obtain a hard copy, contact your Rockwell Automation distributor or sales representative.

Notes:

1769 CompactLogix Controllers Overview

Introduction

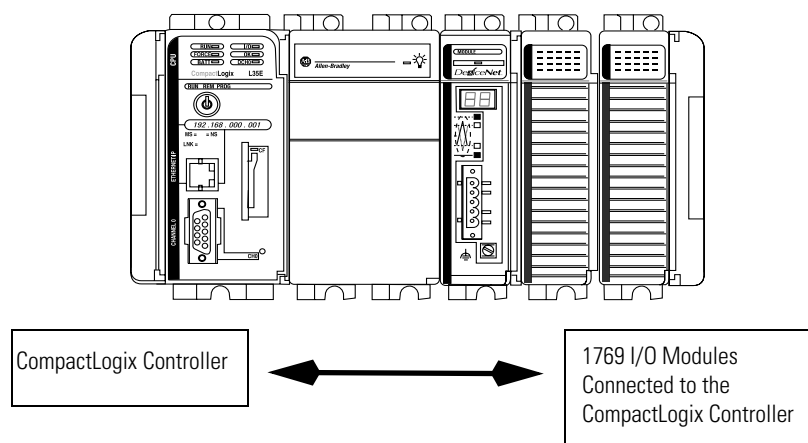
This chapter introduces the 1769 CompactLogix controllers. These controllers offer state-of-the-art control, communications, and I/O elements in a distributed control package.

About the CompactLogix Controllers

The CompactLogix controller offers state-of-the-art control, communications, and I/O elements in a distributed control package.

Topic	Page
Design a CompactLogix System	13
Install Hardware	14

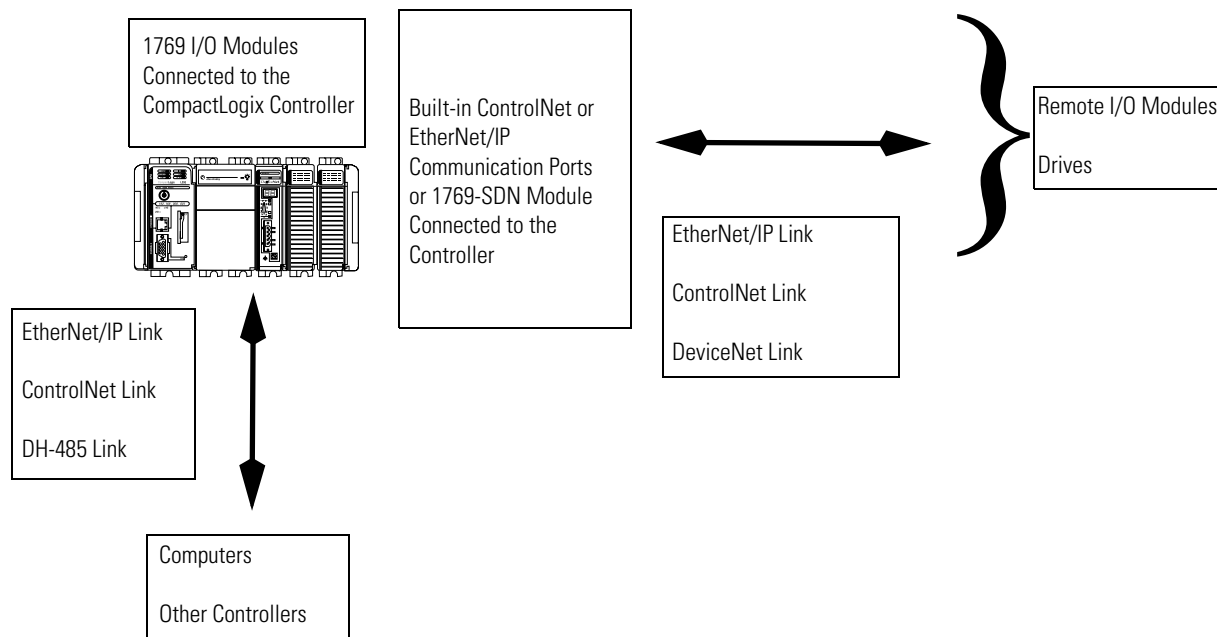
CompactLogix Controller and 1769 I/O Modules



For a more flexible system, use:

- multiple controllers in a single chassis.
- multiple controllers joined across networks.
- I/O in multiple platforms that is distributed in many locations and connected over multiple I/O links.

CompactLogix System Overview



The CompactLogix controller, part of the Logix family of controllers, provides a small, powerful, cost-effective system consisting of:

- RSLogix 5000 programming software.
- built-in communication ports for EtherNet/IP (1769-L32E and 1769-L35E only) and ControlNet (1769-L32C and 1769-L35CR only) networks.
- a 1769-SDN communication interface module providing I/O control and remote device configuration over DeviceNet.
- a built-in serial port on every CompactLogix controller.
- Compact I/O modules providing a compact, DIN-rail or panel-mounted I/O system.

CompactLogix Controller Combinations

Controller	Available Memory	Communication Options	Number of Tasks Supported	Number of Local I/O Modules Supported
1769-L35CR	1.5 MB	1 port ControlNet - supports redundant media	8	30
		1 port RS-232 serial (system or user protocols)		
1769-L35E		1 port EtherNet/IP		
		1 port RS-232 serial (system or user protocols)		
1769-L32C	750 KB	1 port ControlNet	6	16
		1 port RS-232 serial (system or user protocols)		
1769-L32E		1 port EtherNet/IP		
		1 port RS-232 serial (system or user protocols)		
1769-L31	512 KB	1 port RS-232 serial (system or user protocols)	4	
		1 port RS-232 serial (system protocol only)		

Design a CompactLogix System

When designing a CompactLogix system, determine the network configuration and the placement of components in each location. To design your CompactLogix system, you must select:

- I/O devices.
- a communication network.
- controllers.
- power supplies.
- software.

Additional Resources

For more information, consult these publications:

- CompactLogix Selection Guide, publication 1769-SG001.
- Logix5000 Controller Design Considerations Reference Manual, publication 1756-RM094.

Install Hardware

To install a CompactLogix controller, perform these procedures:

1. Set the node address, but only for 1769-L32C and 1769-L35CR controllers.
2. Connect the battery. See the chapter Maintain the Battery.
3. Install a 1784-CF64 CompactFlash card for nonvolatile memory. See the chapter Maintain Nonvolatile Memory.
4. Assemble the system.
5. Mount the system.
6. Establish a serial connection to the controller. See the chapter Connect to the Controller Via the Serial Port.
7. For 1769-L32E and 1769-L35E controllers only, assign an IP address.
8. Make additional network connections. See the section Communicate Over Networks.
9. Install the EDS files.
10. Load the controller firmware.

Additional Resources

For more information, consult these publications:

- 1769-L31 CompactLogix Controller Installation Instructions, publication 1769-IN069
- 1769-L32C, -L35CR CompactLogix Controllers Installation Instructions, publication 1769-IN070
- 1769-L32E, -L35E CompactLogix Controllers Installation Instructions, publication 1769-IN020

Connect to the Controller Via the Serial Port

Introduction

This chapter describes how to connect to the controller via the serial port so you can configure the controller and upload or download a project to the controller.

Topic	Page
Connect to the Controller Via the Serial Port	15
Configure the Serial Driver	17
Select the Controller Path	19
Additional Resources	20

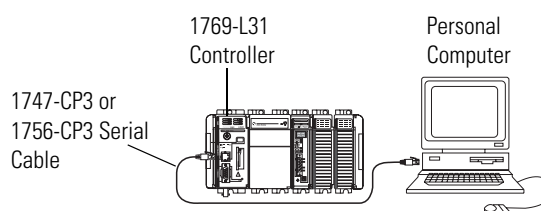
For the CompactLogix controller to operate on a serial network, you need:

- a workstation with a serial port.
- RSLinx software to configure the serial communication driver.
- RSLogix5000 programming software to configure the serial port of the controller.

Connect to the Controller Via the Serial Port

Channel 0 on the CompactLogix controllers is fully isolated and does not need a separate isolation device. Channel 1 on the 1769-L31 is not an isolated serial port.

Serial Connection to Controller

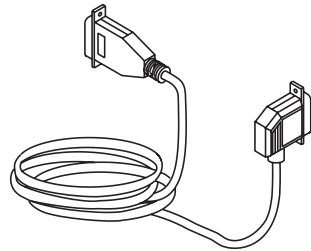


If you connect channel 1 of the 1769-L31 controller to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting the controller directly to a programming workstation. One possible isolator is the 1761-NET-AIC interface converter.

For more information on installing an isolator, see *Configure an Isolator* on page 32.

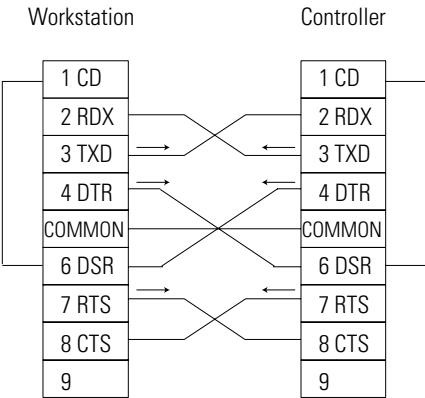
To connect a serial cable, perform this procedure.

- 1. Obtain a 1747-CP3 or 1756-CP3 serial cable.



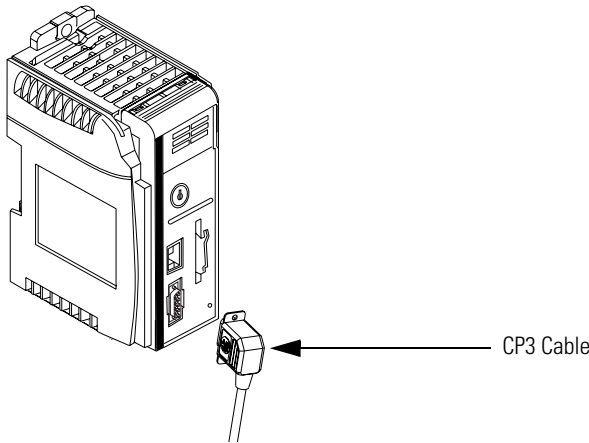
TIP If you make your own serial cable, complete this procedure.

- A. Limit the length to 15.2 m (50 ft).
- B. Wire the connectors.



- C. Attach the shield to both connectors.

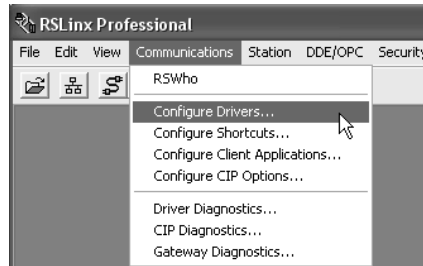
- 2. Connect the cable to your controller and workstation.



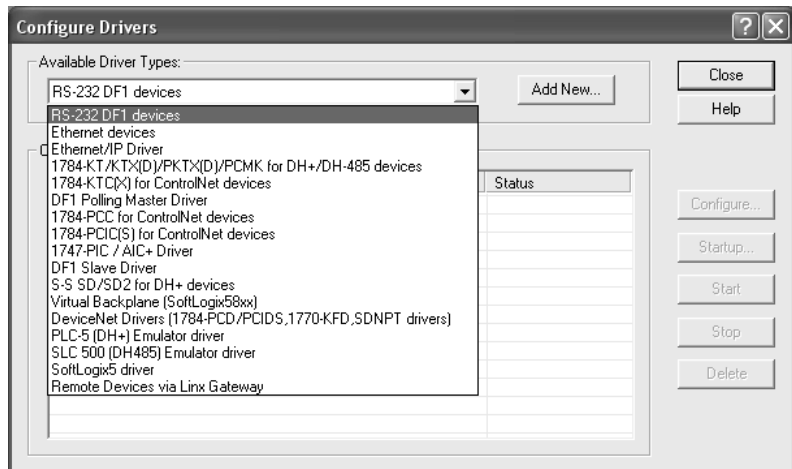
Configure the Serial Driver

Use RSLinx software to configure the RS-232 DF1 Device driver for serial communications. To configure the driver, perform this procedure.

1. From the Communications pull-down menu, choose Configure Drivers.

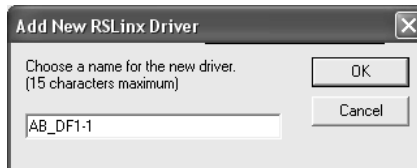


The Configure Drivers dialog appears.



2. From the Available Driver Types pull-down menu, choose the RS-232 DF1 Device driver.
3. Click Add New to add the driver.

The Add New RSLinx Driver dialog appears.



4. Specify the driver name and click OK.

The Configure RS-232 DF1 Devices dialog appears.



- 5. Specify the serial port settings.
 - a. From the Comm Port pull-down menu, choose the serial port on the workstation to which the cable is connected.
 - b. From the Device pull-down menu, choose Logix 5550-Serial Port.
 - c. Click Auto-Configure.
- 6. Verify that the Auto-Configuration was successful.

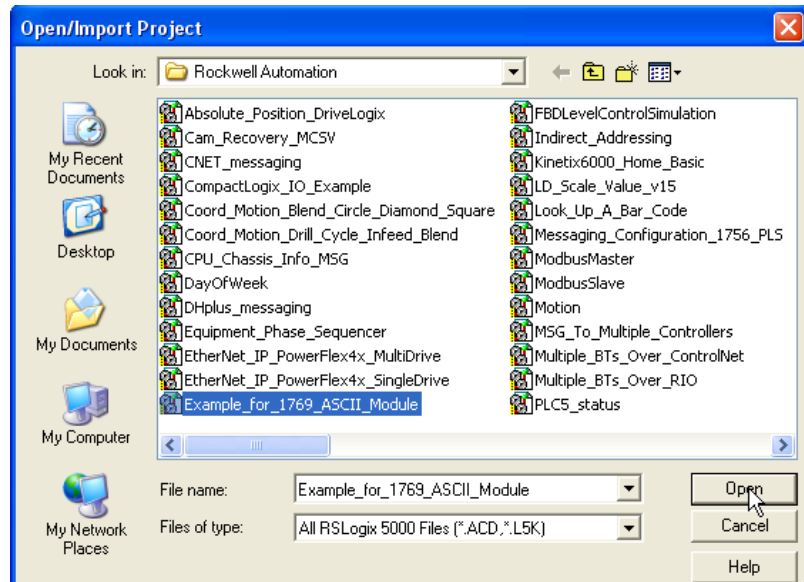
If	Then
Yes	Click OK.
No	Go to step 5 and verify that you selected the correct communications port.

- 7. Click Close.

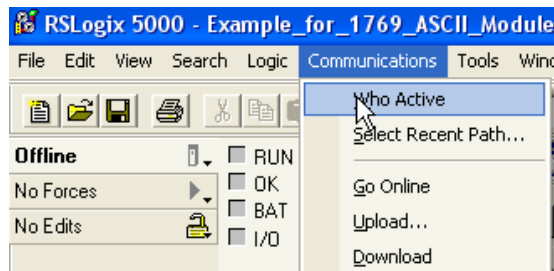
Select the Controller Path

To select the controller path, perform this procedure.

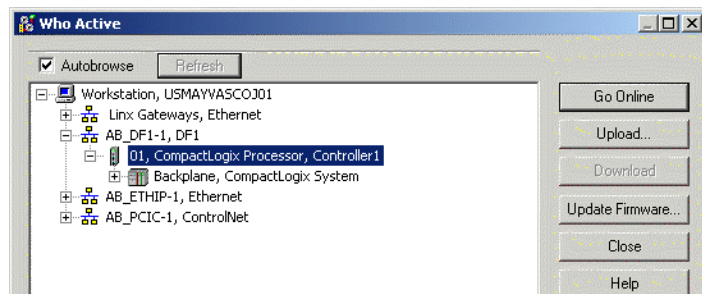
1. In RSLogix 5000 programming software, open a project for the controller.



2. From the Communications pull-down menu, choose Who Active.



The Who Active dialog appears.



3. Expand the communication driver to the level of the controller.
4. Select the controller.

Controller Options

Once you have selected a controller, you have several options.

To	Choose
Monitor the project in the controller	Go Online
Transfer a copy of the project from the controller to RSLogix 5000 software	Upload
Transfer the open project to the controller	Download

Additional Resources

For additional information, consult these publications:

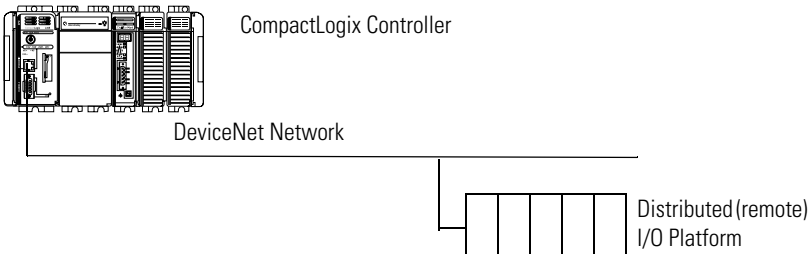
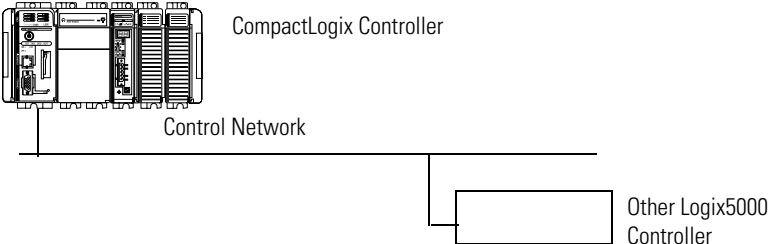
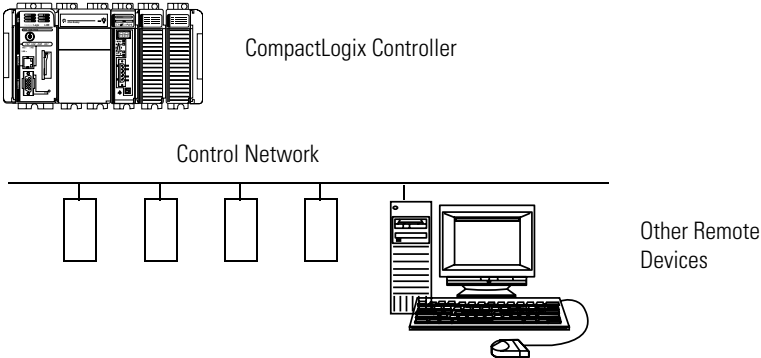
- EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001
- ControlNet Modules in Logix5000 Control System User Manual, publication CNET-UM001
- DeviceNet Modules in Logix5000 Control System User Manual, publication DNET-UM004

Communicate Over Networks

Introduction

This chapter explains how CompactLogix controllers support additional networks to enable various functions.

CompactLogix Controller Network Support

Function	Example
Control distributed (remote) I/O. <ul style="list-style-type: none">• EtherNet/IP• ControlNet• DeviceNet	 <p>CompactLogix Controller</p> <p>DeviceNet Network</p> <p>Distributed (remote) I/O Platform</p>
Produce/consume (interlock) data between controllers. <ul style="list-style-type: none">• EtherNet/IP• ControlNet	 <p>CompactLogix Controller</p> <p>Control Network</p> <p>Other Logix5000 Controller</p>
Send and receive messages to and from other devices. This includes access to the controller via RSLogix 5000 programming software. <ul style="list-style-type: none">• EtherNet/IP• ControlNet• DeviceNet (to devices only)• serial• DH-485	 <p>CompactLogix Controller</p> <p>Control Network</p> <p>Other Remote Devices</p>

Topic	Page
EtherNet/IP Network Communication	22
ControlNet Network Communication	25
DeviceNet Communications	28
Serial Communications	31
DH-485 Network Communications	39

EtherNet/IP Network Communication

The EtherNet/IP network offers a full suite of control, configuration and data collection services by layering the Common Industrial Protocol (CIP) over the standard Internet protocols, such as TCP/IP and UDP. This combination of well-accepted standards provides the capability required to both support information data exchange and control applications.

The EtherNet/IP network also uses commercial, off-the-shelf Ethernet components and physical media, providing you with a cost-effective plant-floor solution.

For EtherNet/IP communications, you can use these CompactLogix controllers with a built-in EtherNet/IP communication port:

- 1769-L32E CompactLogix controller
- 1769-L35E CompactLogix controller

You can use several software products with a 1769 CompactLogix controller on an EtherNet/IP network.

EtherNet/IP Network Software Combinations

Software	Function(s)	Requirement
RSLogix 5000 programming software	<ul style="list-style-type: none"> • Configure the CompactLogix project • Define EtherNet/IP communications 	Yes
BOOTP/DHCP utility with RSLogix 5000 software	Assign IP addresses to devices on an EtherNet/IP network	No
RSNetWorx software for an EtherNet/IP network	Configure EtherNet/IP devices by IP addresses and/or host names	No

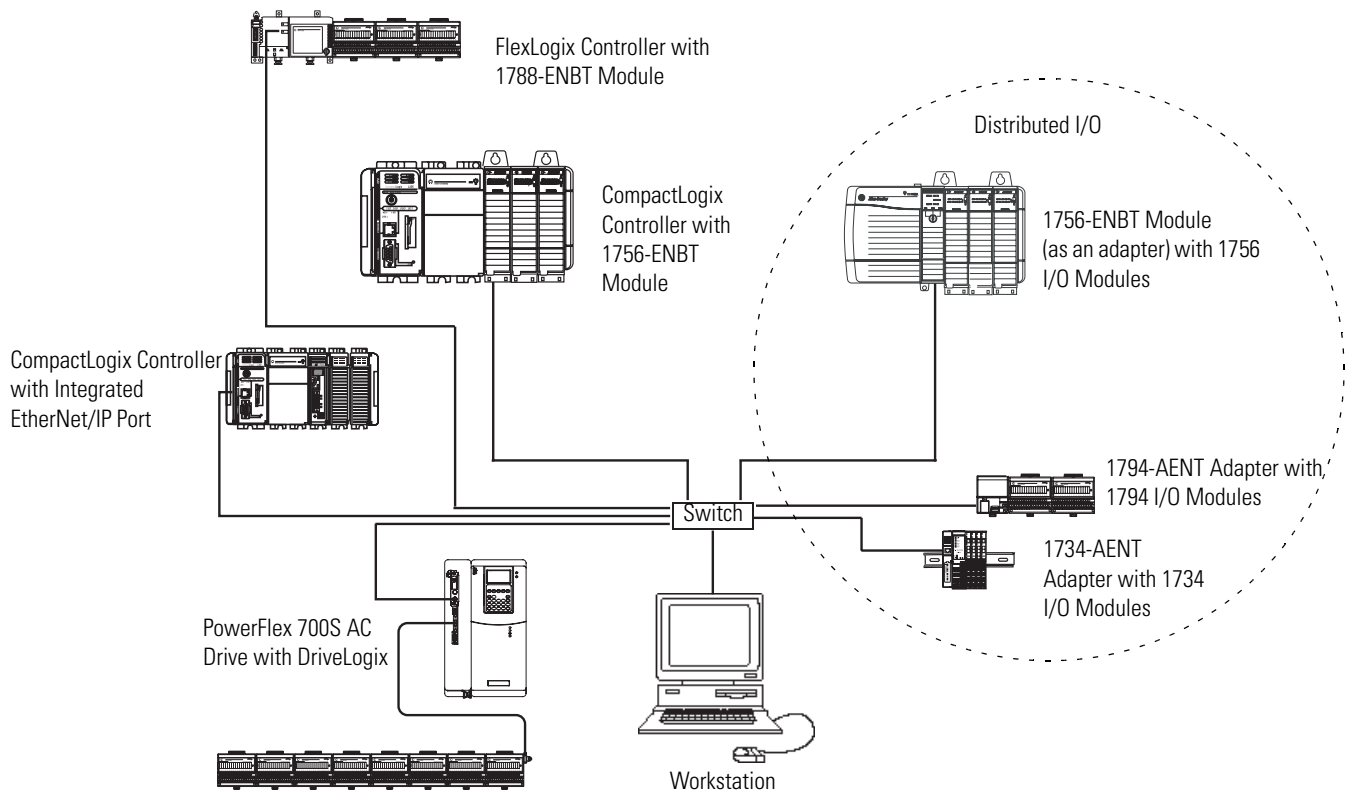
The EtherNet/IP communication modules:

- support messaging, produced/consumed tags, HMI, and distributed I/O.
- encapsulate messages within standard TCP/UDP/IP protocol.
- share a common application layer with ControlNet and DeviceNet.
- interface via RJ45, category 5, unshielded, twisted-pair cable.
- support half/full-duplex 10 Mbps or 100 Mbps operation.
- support standard switches.
- require no network scheduling.
- require no routing tables.

In this example:

- the controllers produce and consume tags amongst themselves.
- the controllers initiate MSG instructions that send and receive data or configure devices.
- the personal computer uploads or downloads projects to the controllers.
- the personal computer configures devices on an EtherNet/IP network.

CompactLogix EtherNet/IP Overview



Connections Over an EtherNet/IP Network

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices than unconnected messages.

All EtherNet/IP connections are unscheduled. An unscheduled connection is a message transfer between controllers that is triggered by the requested packet interval (RPI) or the program, such as a MSG instruction. Unscheduled messaging lets you send and receive data when needed.

The 1769-L32E and 1769-L35E controllers support 100 connections. However, the built-in EtherNet/IP port only supports 32 CIP connections over an EtherNet/IP network. With these controllers, the number of end-node connections they effectively support depends on a connection's RPI.

Requested Packet Interval	Max EtherNet/IP Port Communication Connections
2 ms	2
4 ms	5
8 ms	10
16 ms	18
32 ms+	25+

You can use all 32 communication connections on the built-in EtherNet/IP port. However, we recommend that you leave some connections available for tasks such as going online and non-I/O purposes.

Additional Resources

For more information, consult these publications:

- EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001
- EtherNet/IP Web Server Module User Manual, publication ENET-UM527
- EtherNet/IP Performance Application Guide, publication ENET-AP001
- Logix5000 Controllers Design Considerations Reference Manual, publication 1756-RM094

ControlNet Network Communication

ControlNet is a real-time control network that provides high-speed transport of both time-critical I/O and interlocking data and messaging data, including uploading and downloading of programming and configuration data on a single physical-media link. The ControlNet network's highly-efficient data transfer capability significantly enhances I/O performance and peer-to-peer communication in any system or application.

The ControlNet network is highly deterministic and repeatable and remains unaffected as devices are connected or disconnected from the network. This robust quality results in dependable, synchronized, and coordinated real-time performance.

The ControlNet network most often functions as:

- the default network for the ControlLogix platform.
- a substitute/replacement for the remote I/O (RIO) network because the ControlNet network adeptly handles large numbers of I/O points.
- a backbone to multiple distributed DeviceNet networks.
- a peer interlocking network.

For ControlNet communications, you can use these CompactLogix controllers with a built-in ControlNet communication port:

- 1769-L32C CompactLogix controller
- 1769-L35CR CompactLogix controller

You can use these software products with a 1769 CompactLogix controller on a ControlNet network.

ControlNet Network Software Combinations

Software	Function(s)	Requirement
RSLogix 5000 programming software	<ul style="list-style-type: none"> • Configure the CompactLogix project • Define EtherNet/IP communications 	Yes
RSNetWorx software for ControlNet	<ul style="list-style-type: none"> • Configure the ControlNet network • Define the NUT (network update time) • Schedule the ControlNet network 	

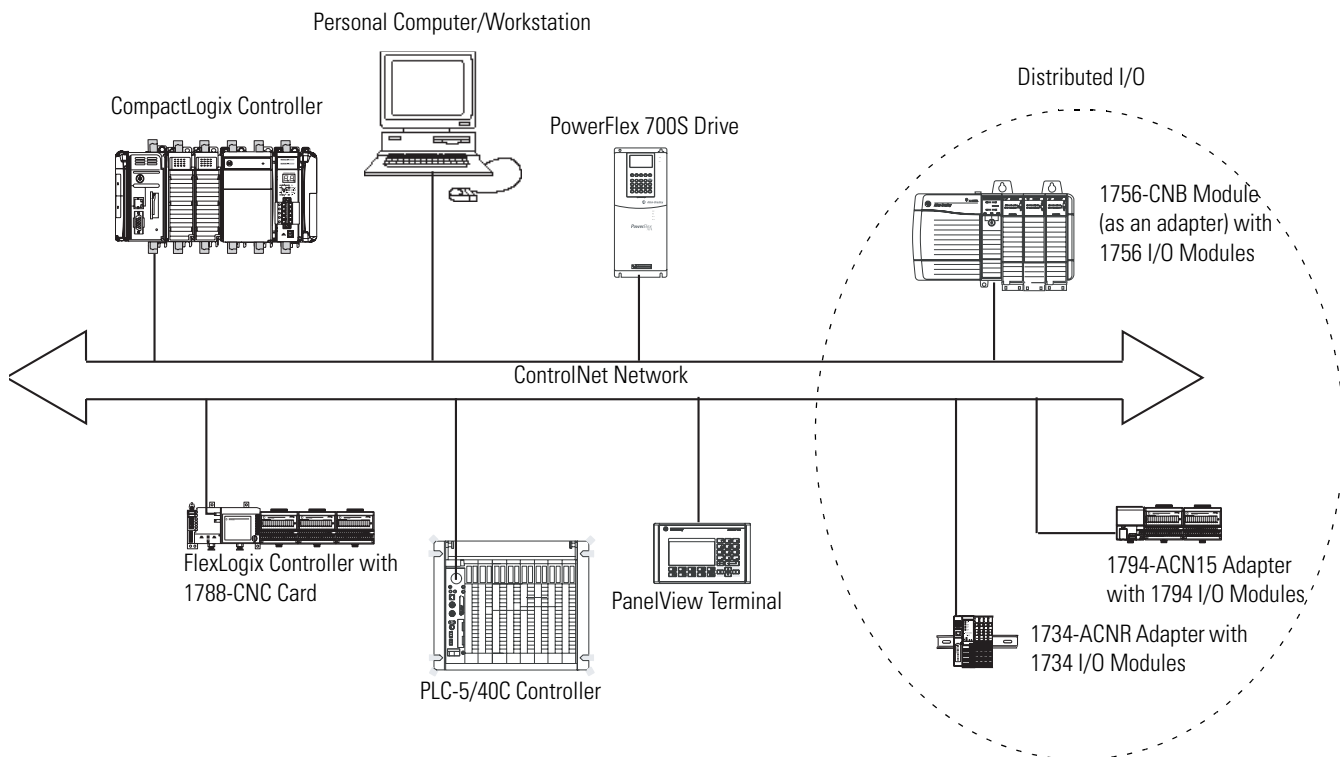
The ControlNet communications modules:

- support messaging, produced/consumed tags and distributed I/O.
- share a common application layer with DeviceNet and EtherNet/IP networks.
- require no routing tables.
- support the use of coax and fiber repeaters for isolation and increased distance.

In this example:

- the controllers produce and consume tags amongst themselves.
- the controllers initiate MSG instructions that send and receive data or configure devices.
- the personal computer uploads or downloads projects to the controllers.
- the personal computer configures devices on ControlNet, and configures the network itself.

CompactLogix ControlNet Overview



Connections Over ControlNet

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices compared to unconnected messages.

ControlNet Connection Methods

Connection Method	Description
Scheduled	<p>A scheduled connection is unique to ControlNet communications. A scheduled connection lets you send and receive data repeatedly at a set interval, which is the requested packet interval (RPI). For example, a connection to an I/O module is a scheduled connection because you repeatedly receive data from the module at a specified interval. Other scheduled connections include connections to:</p> <ul style="list-style-type: none"> communication devices. produced/consumed tags. <p>On a ControlNet network, you must use RSNetWorx for ControlNet to enable all scheduled connections and establish a network update time (NUT). Scheduling a connection reserves network bandwidth to specifically handle the connection.</p>
Unscheduled	<p>An unscheduled connection is a message transfer between nodes that is triggered by ladder logic or the program (such as a MSG instruction). Unscheduled messaging lets you send and receive data when needed. Unscheduled messages use the remainder of network bandwidth after scheduled connections are allocated.</p>

The 1769-L32C and 1769-L35CR controllers support 100 connections. However, the built-in ControlNet port only supports 32 communication connections. With these controllers, the number of end-node connections they effectively support depends on the connection's NUT and RPI.

NUT	RPI	Supported ControlNet Communication Connections ⁽¹⁾
2 ms	2 ms	0...1
3 ms	3 ms	1...2
5 ms	5 ms	3...4
10 ms	10 ms	6...9
14 ms	14 ms	10...12
5 ms	20 ms	12...16
4 ms	64 ms	31

⁽¹⁾ For each NUT/RPI combination, the number of connections supported is listed in a range. The lower number is the number of connections we recommend you make to maintain reasonable ControlNet port CPU utilization rates. The higher number is the maximum number of connections possible for that NUT/RPI combination.

You can use all 32 communication connections on the built-in ControlNet port. However, we recommend that you leave some connections available for tasks such as going online and unscheduled network traffic.

Additional Resources

For additional information, consult these publications:

- Control Net Modules in Logix5000 Control Systems User Manual, publication CNET-UM001
- Logix5000 Controllers Design Considerations Reference Manual, publication 1756-RM094

DeviceNet Communications

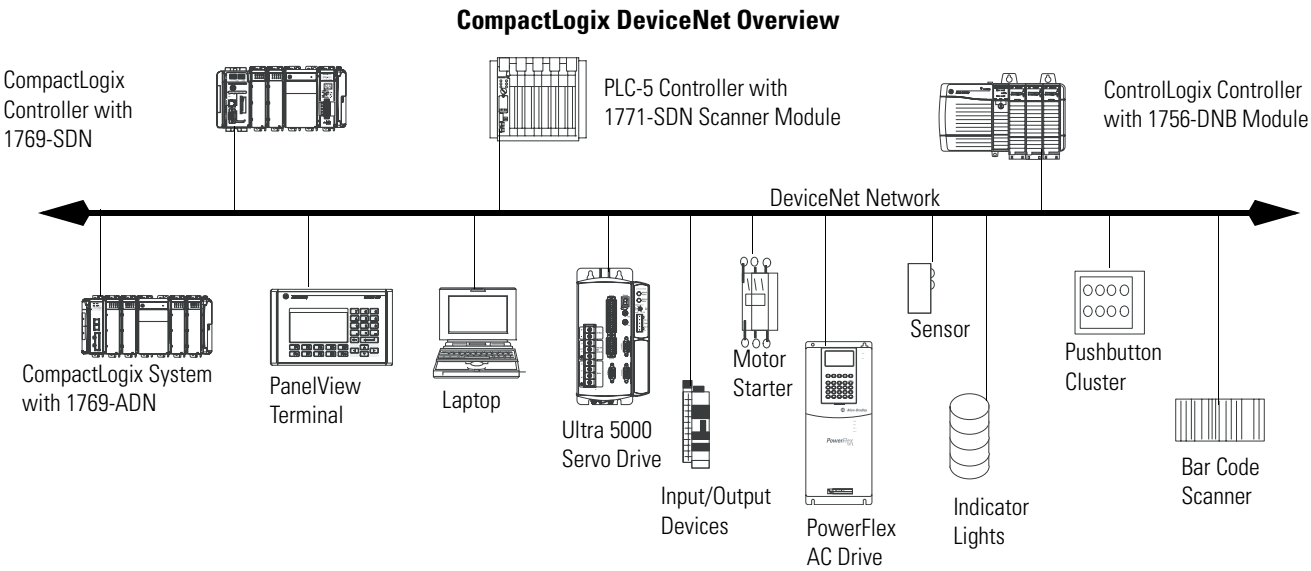
The DeviceNet network uses the Common Industrial Protocol (CIP) to provide the control, configuration, and data collection capabilities for industrial devices. The DeviceNet network uses the proven Controller Area Network (CAN) technology, which lowers installation costs and decreases installation time and costly downtime.

A DeviceNet network provides access to the intelligence present in your devices by letting you connect devices directly to plant-floor controllers without having to hard wire each device into an I/O module.

CompactLogix DeviceNet Communications Interfaces

If your application	Select
<ul style="list-style-type: none">• Communicates with other DeviceNet devices• Uses the controller as a master or slave on DeviceNet• Uses a controller ControlNet, Ethernet or serial port for other communications	1769-SDN DeviceNet scanner module
<ul style="list-style-type: none">• Accesses remote Compact I/O over a DeviceNet network• Sends remote I/O data for as many as 30 modules back to scanner or controller	1769-ADN DeviceNet adapter module ⁽¹⁾

⁽¹⁾ This table specifically describes using the 1769-ADN module to access remote Compact I/O over DeviceNet. However, CompactLogix controllers can access other Allen-Bradley remote I/O over DeviceNet. In those cases, you must select the appropriate interface. For example, if accessing remote POINT I/O modules, you must select the 1734-ADN.



You can use these software products with a 1769 CompactLogix controller on a DeviceNet network.

CompactLogix DeviceNet Software Combinations

Software	Function(s)	Requirement
RSLogix 5000 programming software	<ul style="list-style-type: none">• Configure the CompactLogix project• Define EtherNet/IP communications	Yes
RSNetWorx software for DeviceNet devices	<ul style="list-style-type: none">• Configure DeviceNet devices• Define the scan list for DeviceNet devices	

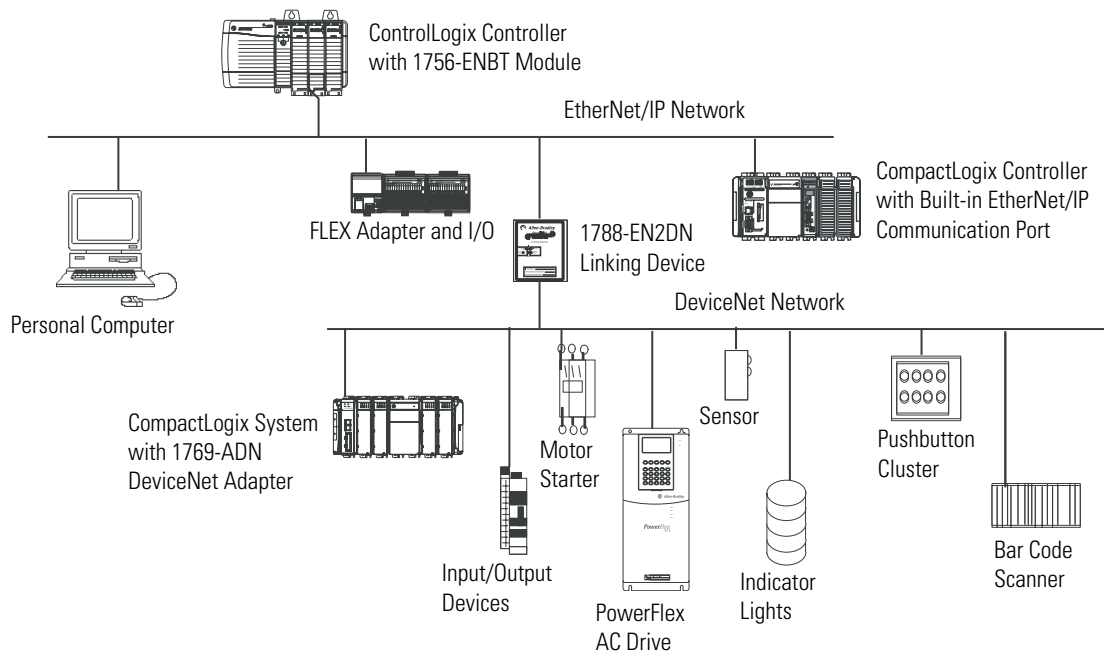
The DeviceNet communications module:

- supports messaging to devices, not controller to controller.
- shares a common application layer with ControlNet and EtherNet/IP.
- offers diagnostics for improved data collection and fault detection.
- requires less wiring than traditional, hardwired systems.

You can use a linking device as a:

- gateway to connect information.
- control-level network to device-level network for programming, configuration, control or data collection.
- router/bridge to connect the EtherNet/IP or ControlNet network to the DeviceNet network.

CompactLogix Linking Device Overview



Additional Resources

For additional information, consult these publications:

- DeviceNet Modules in Logix5000 Control Systems User Manual, publication DNET-UM004
- Logix5000 Controllers Design Considerations Reference Manual, publication 1756-RM094

Serial Communications

CompactLogix controllers have a built-in RS-232 port.

- 1769-L32C, -L32E, -L35CR, and -L35E CompactLogix controllers have one built-in RS-232 port. By default, that port is channel 0 on these controllers.
- The 1769-L31 CompactLogix controller has two RS-232 ports. One port only allows DF1 protocol only. The second port accepts DF1 and ASCII protocol.

IMPORTANT

Limit the length of serial (RS-232) cables to 15.2 m (50 ft).

You can configure the serial port of the controller for several modes.

CompactLogix Serial Port Configuration

Mode	Function(s)
DF1 Point-to-Point	<p>Communicate between the controller and one other DF1-protocol-compatible device.</p> <p>This is the default system mode. Default parameters are:</p> <ul style="list-style-type: none"> • Baud Rate: 19,200 • Data Bits: 8 • Parity: None • Stop Bits: 1 • Control Line: No Handshake • RTS send Delay: 0 • RTS Off Delay: 0 <p>This mode is typically used to program the controller through its serial port.</p>
DF1 Master	<p>Control polling and message transmission between the master and slave nodes.</p> <ul style="list-style-type: none"> • The master/slave network includes one controller configured as the master node and as many as 254 slave nodes. Link slave nodes using modems or line drivers. • A master/slave network can have node numbers from 0...254. Each node must have a unique node address. Also, at least 2 nodes must exist to define your link as a network (1 master and 1 slave station are the two nodes).
DF1 Slave	<p>Use a controller as a slave station in a master/slave serial communication network.</p> <ul style="list-style-type: none"> • When there are multiple slave stations on the network, link slave stations using modems or line drivers to the master. When you have a single slave station on the network, you do not need a modem to connect the slave station to the master. You can configure the control parameters for no handshaking. You can connect 2...255 nodes to a single link. In DF1 slave mode, a controller uses DF1 half-duplex protocol. • One node is designated as the master and it controls who has access to the link. All the other nodes are slave stations and must wait for permission from the master before transmitting.
User (channel 0 only)	<p>Communicate with ASCII devices.</p> <p>This requires your program to use ASCII instructions to transmit data to and from ASCII device.</p>
DH-485	<ul style="list-style-type: none"> • Communicate with other DH-485 devices. • This multi-master, token-passing network allows programming and peer-to-peer messaging.
DF1 Radio Modem	<ul style="list-style-type: none"> • Compatible with SLC500 and MicroLogix1500 controllers. • This mode supports master and slave, and store and forward modes.

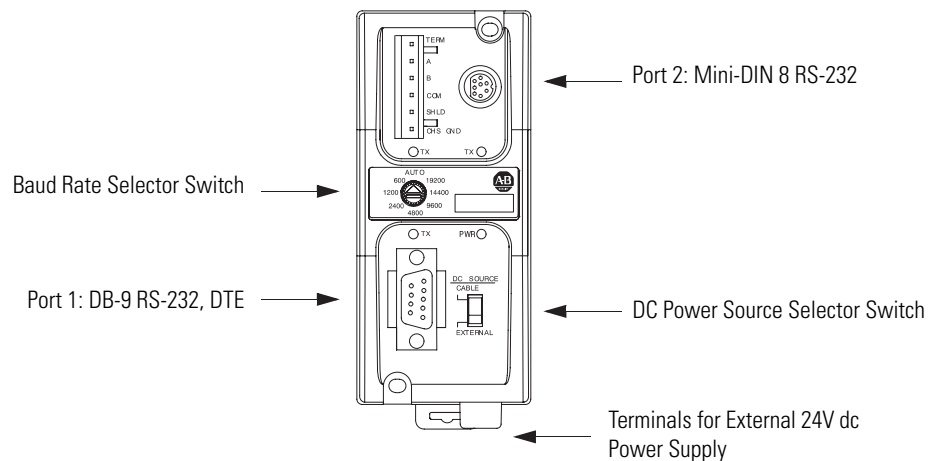
Configure an Isolator

Channel 0 on the CompactLogix controllers is fully isolated and does not need a separate isolation device. Channel 1 on the 1769-L31 controller is not an isolated serial port. To configure an isolator, perform this procedure.

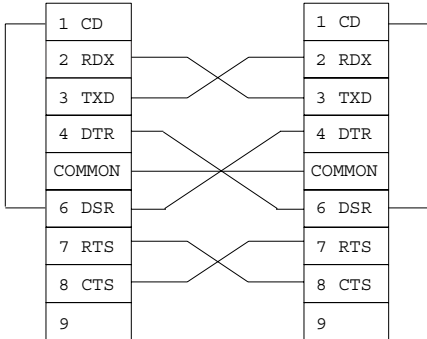
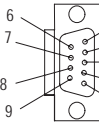

1. Determine whether you need an isolator.

If you connect channel 1 of the 1769-L31 controller to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting the controller directly to a programming workstation.

One possible isolator is the 1761-NET-AIC interface converter.



2. Select the appropriate cable.

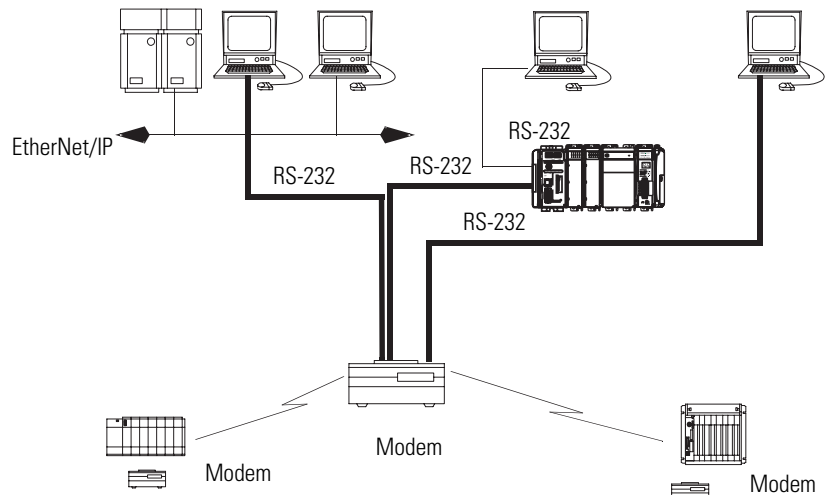
Are you using an isolator?	Then use this cable																														
No	<p>The 1756-CP3 cable attaches the controller directly to the controller.</p> <div></div> <p>If you make your own cable, it must be shielded, and the shields must be tied to the metal shell (that surrounds the pins) on both ends of the cable.</p> <p>You can also use a 1747-CP3 cable from the SLC product family. This cable has a taller right-angle connector housing than that of the 1756-CP3 cable.</p>																														
Yes	<p>The 1761-CBL-AP00 cable (right-angle connector to controller) or the 1761-CBL-PM02 cable (straight connector to the controller) attaches the controller to port 2 on the 1761-NET-AIC isolator. The mini-DIN connector is not commercially available, so you cannot make this cable.</p> <div><div><p>DB-9 Right-angle or Straight Cable End</p></div><div><p>8-pin, Mini-DIN Cable End</p></div></div> <table><tr><th>Pin</th><th>DB-9 End</th><th>Mini-DIN End</th></tr><tr><td>1</td><td>DCD</td><td>DCD</td></tr><tr><td>2</td><td>RxD</td><td>RxD</td></tr><tr><td>3</td><td>TxD</td><td>TxD</td></tr><tr><td>4</td><td>DTR</td><td>DTR</td></tr><tr><td>5</td><td>Ground</td><td>Ground</td></tr><tr><td>6</td><td>DSR</td><td>DSR</td></tr><tr><td>7</td><td>RTS</td><td>RTS</td></tr><tr><td>8</td><td>CTS</td><td>CTS</td></tr><tr><td>9</td><td>NA</td><td>NA</td></tr></table>	Pin	DB-9 End	Mini-DIN End	1	DCD	DCD	2	RxD	RxD	3	TxD	TxD	4	DTR	DTR	5	Ground	Ground	6	DSR	DSR	7	RTS	RTS	8	CTS	CTS	9	NA	NA
Pin	DB-9 End	Mini-DIN End																													
1	DCD	DCD																													
2	RxD	RxD																													
3	TxD	TxD																													
4	DTR	DTR																													
5	Ground	Ground																													
6	DSR	DSR																													
7	RTS	RTS																													
8	CTS	CTS																													
9	NA	NA																													

3. Connect the appropriate cable to the serial port.

Communicate with DF1 Devices

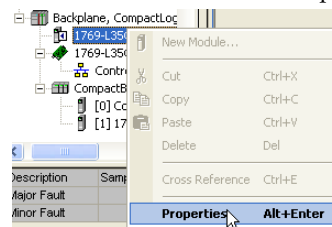
You can configure the controller as a master or slave on a serial communication network. Use serial communications when:

- the system contains three or more stations.
- communications occur regularly and require leased-line, radio, or power-line modems.

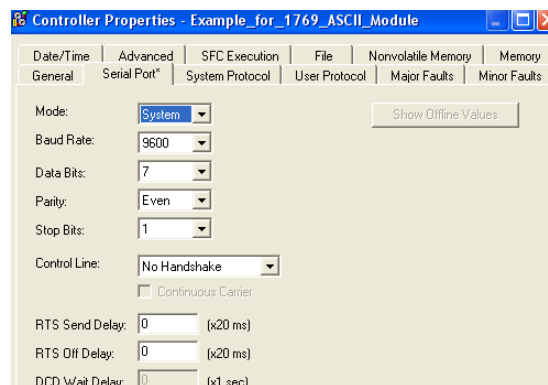


To configure the controller for DF1 communications, perform this procedure.

1. In RSLogix 5000 programming software, right-click your controller and select Properties.

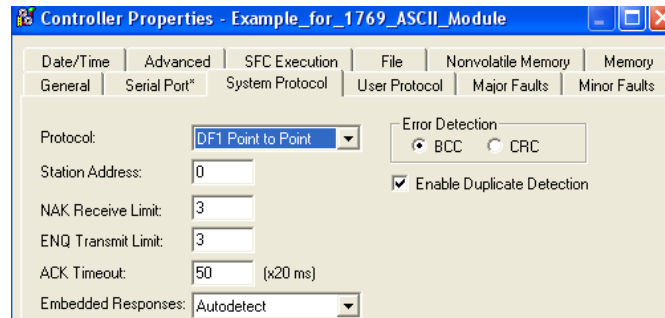


The Controller Properties dialog appears.



2. Click the Serial Port tab.

3. From the Mode pull-down menu, choose System.
4. Specify communication settings.
5. Click the System Protocol tab.



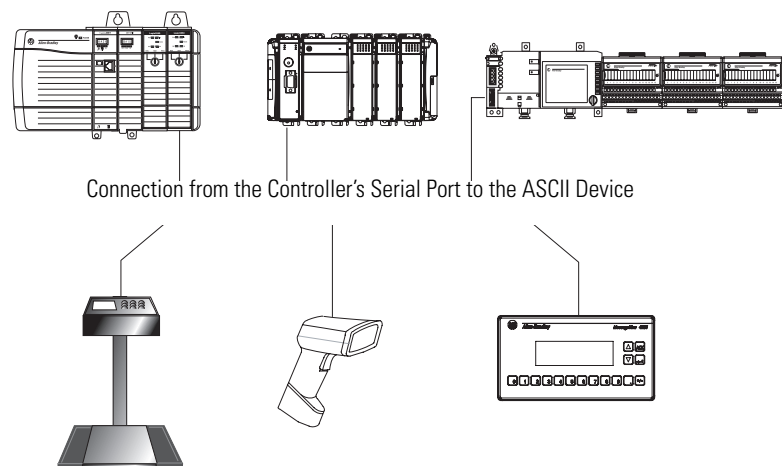
6. From the Protocol pull-down menu, choose a DF1 protocol.
7. Specify DF1 settings.

Communicate with ASCII Devices

You can use the serial port to interface with ASCII devices when the controller is configured for user mode. For example, you can use the serial port to:

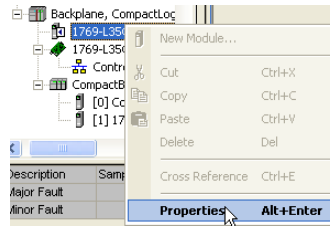
- read ASCII characters from a weigh scale module or bar code reader.
- send and receive messages from an ASCII triggered device, such as a MessageView terminal.

ASCII Device Serial Communications

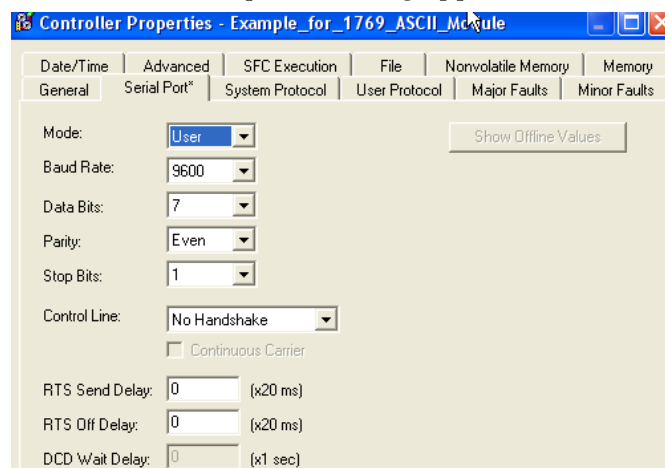


To configure the controller for ASCII communications, perform this procedure.

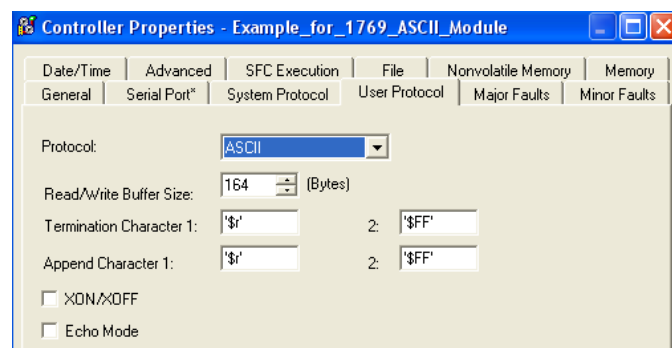
1. In RSLogix 5000 programming software, right-click your controller and select Properties.



The Controller Properties dialog appears.



2. Click the Serial Port tab.
3. From the Mode pull-down menu, choose User.
4. Specify communication settings.
5. Click the User Protocol tab.



6. From the Protocol pull-down menu, choose ASCII.
7. Specify ASCII settings.

The controller supports several instructions to manipulate ASCII characters. The instructions are available in ladder diagram (LD) and structured text (ST).

Read and Write ASCII Characters

Instruction Code	Description
ABL	Determine when the buffer contains termination characters
ACB	Count the characters in the buffer
ACL	Clear the buffer
	Clear out ASCII Serial Port instructions that are currently executing or are in the queue
AHL	Obtain the status of the serial port control lines
	Turn on or off the DTR signal
	Turn on or off the RTS signal
ARD	Read a fixed number of characters
ARL	Read a varying number of characters, up to and including the first set of termination characters
AWA	Send characters and automatically append one or two additional characters to mark the end of the data
AWT	Send characters

Create and Modify Strings of ASCII Characters

Instruction Code	Description
CONCAT	Add characters to the end of a string
DELETE	Delete characters from a string
FIND	Determine the starting character of a substring
INSERT	Insert characters into a string
MID	Extract characters from a string

Convert Data to or from ASCII Characters

Instruction Code	Description
STOD	Convert the ASCII representation of an integer value to a SINT, INT, DINT, or REAL value
STOR	Convert the ASCII representation of a floating-point value to a REAL value
DTOS	Convert a SINT, INT, DINT, or REAL value to a string of ASCII characters
RTOS	Convert a REAL value to a string of ASCII characters
UPPER	Convert the letters in a string of ASCII characters to upper case
LOWER	Convert the letters in a string of ASCII characters to lower case

Modbus Support

To use Logix5000 controllers on Modbus, connect the controllers through the serial port and execute specific ladder logic routines.

A sample controller project is available with RSLogix 5000 Enterprise programming software. To view sample projects, see Sample Controller Projects on pg. 70.

Additional Resources

For more information, consult these publications:

- Logix5000 Controllers Common Procedures Manual, publication 1756-PM001
- Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003
- SCADA System Application Guide, publication AG-UM008
- Logix5000 Controllers as Masters or Slaves on Modbus Application Solution, publication CIG-AP129

DH-485 Network Communications

For DH-485 communication, use the controller's serial port.

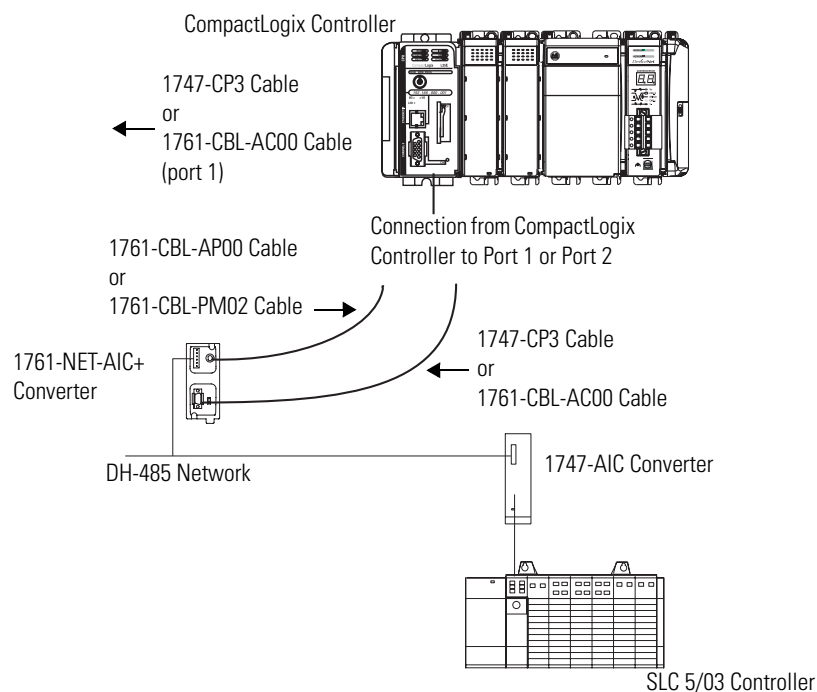
However, with a CompactLogix controller, we recommend that you use NetLinx networks, such as EtherNet/IP, ControlNet, or DeviceNet, because excessive traffic on a DH-485 network may make it impractical to connect to a controller with RSLogix 5000 programming software.

IMPORTANT

If your application uses connections to DH-485 networks, select built-in serial ports.

The DH-485 protocol uses RS-485 half-duplex as its physical interface. RS-485 is a definition of electrical characteristics, not a protocol. You can configure the CompactLogix controller's RS-232 port to act as a DH-485 interface. By using a 1761-NET-AIC converter and the appropriate RS-232 cable (1756-CP3 or 1747-CP3), a CompactLogix controller can send and receive data on a DH-485 network.

CompactLogix DH-485 Communications Overview



On the DH-485 network, the CompactLogix controller can send and receive messages to and from other controllers.

IMPORTANT

A DH-485 network consists of multiple cable segments. Limit the total length of all the segments to 1219 m (4000 ft).

For the controller to operate on a DH-485 network, you need a 1761-NET-AIC interface converter for each controller you want to put on the DH-485 network.

You can have two controllers for each 1761-NET-AIC converter, but you need a different cable for each controller.

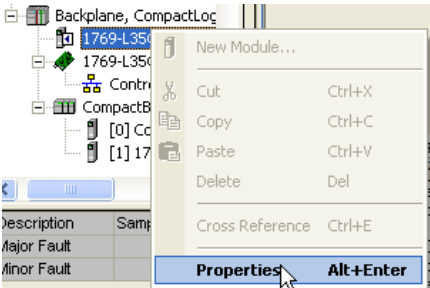
To establish DH-485 communication, perform this procedure.

1. Connect the serial port of the controller to either port 1 or port 2 of the 1761-NET-AIC converter.
2. Use the RS-485 port to connect the converter to the DH-485 network.

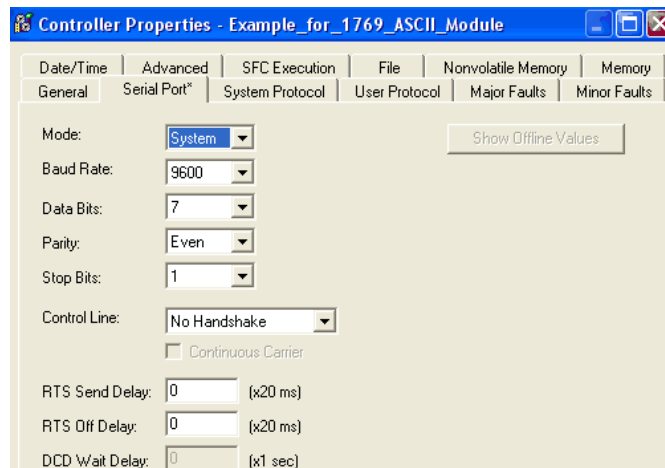
The cable you use to connect the controller depends on the port you use on the 1761-NET-AIC converter.

Connection	Required Cable
Port 1 DB-9 RS-232, DTE connection	1747-CP3 or 1761-CBL-AC00
Port 2 mini-DIN 8 RS-232 connection	1761-CBL-AP00 or 1761-CBL-PM02

3. In RSLogix 5000 programming software, right-click on your controller and choose Properties.



The Controller Properties dialog appears.

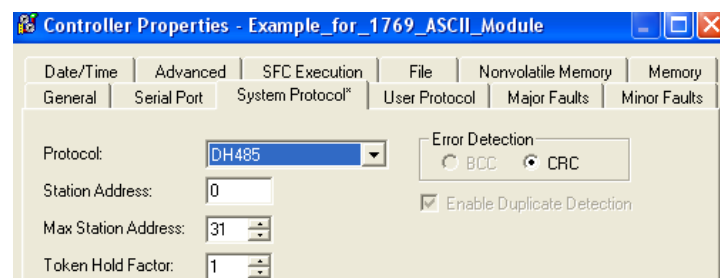


4. Click the Serial Port tab.
5. From the Mode pull-down menu, choose System.
6. Specify communication settings.

IMPORTANT

The baud rate specifies the communication rate for the DH-485 port. All devices on the same DH-485 network must be configured for the same baud rate. Select 9600 or 19200 KB.

7. Click the System Protocol tab.



8. From the Protocol pull-down menu, choose DH485.
9. Specify DH-485 settings.
10. From the Protocol pull-down menu, choose DF1 Radio.